

A DAY AT A LEEDS WOOLLEN-FACTORY.



[Coloured-Cloth Hall, Leeds.]

WHEN Leland, three centuries ago, called Leeds a "praty mercat toun, having one paroch church, reasonably well buildd," it is evident that he did not regard it as a busy centre of manufacturing operations, receiving the produce of the neighbourhood, and distributing it to all quarters of the world. Nor indeed are there any indications that the present "clothing metropolis" was at that time eminent in respect of the woollen manufactures of the West Riding; for it is mentioned as being subordinate to Halifax, to Wakefield, and to Bradford. And even all these towns taken collectively did not represent the chief seat of this branch of productive industry; since the West of England was at that time, and continued to be till a comparatively recent period, the most important clothing district in England.

The changes which the woollen manufacture, as respects both localization and mode of management, has been and is now undergoing, are very remarkable. Some years ago the 'West of England cloths' were the test of excellence in this manufacture; while the productions of Yorkshire were deemed of a coarser and cheaper character. At present, although the western counties have not deteriorated in their product, the West Riding of Yorkshire has made giant strides, by which equal skill in every department has been attained; while the commercial advantages resulting from coal-mines, from water-power, from canals and railroads, and from vicinage to the eastern port of Hull and the western port of Liverpool, give to the West

Riding a power which Gloucestershire and Somersetshire cannot equal. The steam-engine, too, and various machines for facilitating some of the manufacturing processes, have been more readily introduced into the former than into the latter; a circumstance which, even without reference to other points of comparison, is sufficient to account for much of the recent advance in the north.

When we look at a map of any district where the woollen manufacture has been long carried on, we find that it usually exhibits a range of hills and valleys, with streams flowing from and between the former into the latter; and a glance at the processes of manufacture shows why this is the case. The water required in both the preparatory and the finishing processes, and the power required to work the fulling-stocks, rendered the vicinage of a river very important, especially when steam-engines and Artesian wells were hardly known. Dyer, in his poem of 'The Fleece'—a production more remarkable for the singularity of its object than for the excellence of its poetry, it being a kind of history of wool and the woollen trade "done into verse"—notices in the following lines some of the uses to which a clear stream was applied by the clothiers of eighty years ago:—

"Next, from the slacken'd beam the woof unroll'd,
Near some clear-sliding river, Aire or Stroud,
Is by the noisy fulling-mill receiv'd;
Where tumbling waters turn enormous wheels,
And hammers, rising and descending, learn

To imitate the industry of man.
 Oft the wet web is steeped, and often rais'd,
 Fast-dripping, to the river's grassy bank;
 And sinewy arms of men, with full-strain'd strength,
 Wring out the latent water."

Whether we go into Gloucestershire, Wiltshire, or Yorkshire, we shall find these streams watering the clothing districts. In Gloucestershire there is a district called the "Bottoms," containing the parishes and towns of Dursley, Cam, Uley, Alderley, Wickwar, Stroud, Woodton-under-Edge, Avening, Painswick, Pitchcomb, Randwick, Minchenhampton, Biesly, Rodborough, Stonehouse, King's Stanley, Leward Stanley, Wood Chester, Horsley, and Eastington,—in which, and in all the villages around, woollen cloths are manufactured in large number; Stroud being a kind of centre to the whole; and here we find the Stroud-Water and other small streams flowing past these several places towards the Severn. In Wiltshire the chief clothing towns, Bradford, Chippenham, Melksham, Trowbridge, and Westbury, are all situated either on the Avon itself or on one of the streams flowing into it. In Yorkshire, in like manner, the busy clothing towns of Leeds, Bradford, Halifax, Huddersfield, Wakefield, Dewsbury, Keighley, &c. are situated on the banks of streams which are perhaps more abundantly used as manufacturing aids than any others in England, except the Mersey and the Irwell.

We hope to be able, by describing what comes under notice in a visit to one of the large cloth-factories of modern times, to give a general idea of this very interesting branch of manufacture. But there are two matters which must first be glanced at before the true position of such establishments can be understood; viz. the difference between *woollen* and *worsted* goods, and the difference between the *factory* and the *domestic* systems of working. As respects the first point, the sheep's wool employed is separated into two kinds, one of which is long in fibre and the other short; the former being spun and woven much in the same way as cotton or silk goods, while the latter, besides being spun and woven, is *felted*, *fulled*, or *milled*, so as to produce that peculiarity of surface which distinguishes all woollen cloth. These two branches of manufacture are wholly distinct; different kinds of wool being employed, different machines applied, different factory arrangements made, and different market-halls established. The shalloons, camlets, tabinets, merinos, moreens, duroys, lastings, calimancoes, and a host of other varieties of worsted goods—forming the staple products of Bradford and other towns in the West Riding—will not come under our notice in the present article, the object here being confined to *woollen* manufactures properly so called.

As respects the second point, the difference between the modes of conducting the woollen manufacture is very remarkable. There are three systems followed; the first in the West of England, the second in a large number of villages west and south of Leeds, and the third principally in the towns of Leeds, Halifax, and Huddersfield. In the *master-clothier* system of the West of England the manufacturer buys his wool from the importer or the wool-stapler, and employs persons to work it up into cloth, giving each separate process to distinct sets of men, who work either at their own houses or at the house of the master-clothier. As each man only performs one process, he acquires great manual dexterity at it; and the excellence of the West of England cloth used to be in great part attributed to this subdivision of employment. So high, indeed, was the reputation of the cloths sold at the Stroud and Wiltshire markets, that, before the rapid rise of the Yorkshire manufacture, the Yorkshire clothiers used frequently to travel to the West of Eng-

land to purchase wool, return to the north to work it up into cloth, and re-convey it for sale to the West of England, as being the most flourishing mart for this commodity.

The *domestic* system of the Yorkshire villages differs considerably from the above. Here the actual workman is a small manufacturer on his own account, and this was the general system pursued before the application of large capitals to the business. These small manufacturers frequently occupy small farms, partly as a means of support, and partly for the convenience of the manufacture. The domestic clothiers have in their houses from one to four looms, on which, and in the process connected with the spinning of the woollen yarn, they employ themselves, their wives and children and sometimes a few workpeople from their neighbourhood. During harvest the females and children go out to work in the fields. In the primitive form of this system the domestic clothiers carried on the whole process of the manufacture, up to the state of undressed cloth; but as the advantages of machinery and of combined capital became apparent, they gradually adopted a curious mean between the factory and the domestic systems. They erected joint-stock mills by contributions from among themselves, or else independent parties established such mills; and with the aid of these mills, the domestic system now assumes the following form:—the domestic clothier, after purchasing his wool and deciding on the mode in which it shall be worked up, sends it to a mill to be prepared for spinning; it is then brought home for his wife and children to spin, and for him to weave into cloth; it then goes again to the mill to be 'fulled;' and, after being again returned to the clothier, is by him carried a stage or two further, and then sold in the state of 'undressed cloth,' sometimes dyed, and in other cases white. We shall further illustrate some of the features of the domestic system in a future page.

The *factory* system of cloth manufacturing bears a close analogy to that of cotton; it being the growth of steam-power, mechanical invention, and accumulated capital. In the large woollen factories, every step of the process is carried on in one building or one range of buildings, from the sorting of the wool to the pressing of the finished woollen cloth. In this system, as in that of the master-clothiers, the workmen have no property in the material which they are fabricating, their remuneration being simply in the form of wages for labour bestowed; whereas in the domestic system the manufacturer unites the characters of master and workman in himself.

Let us now witness the arrangements and follow the routine of processes in a large woollen-factory, as a means of obtaining a knowledge of the manufacture.

Among the large cloth-factories at Leeds, that of Messrs. B. Gott and Sons, which, by the kind permission of the proprietors, we have been allowed to visit, is well calculated to facilitate our present object from the completeness and large extent on which all the processes of the manufacture are there conducted. Leeds, on whichever side we approach it, present marked evidence, by the numerous tall chimneys visible on every side, of the extensive manufacturing operations carried on. It was estimated in 1838 there were at that time 106 woollen-mills in the parish of Leeds, employing 9738 hands, 2721 of whom were females; and that there were altogether more than three hundred steam-engines at work in the parish about half of which were employed in the textile manufactures.* Leeds must necessarily, therefore

* The existence and extent of the textile manufactures in the eastern part of the town are curiously illustrated by the name of a cluster of five small streets there situated—Mill Street, Worsted Street, Spinner Street, Cotton Street, and Silk Street.

present much of the smoke and bustle of our busiest towns. The greater part of these factories are congregated near or on the banks of the river Aire, which flows through the town from west to east, and presents every indication of commercial activity. When standing on the principal bridge of Leeds, leading from Hunslet to the main High Street, called Briggate, a glance around reveals much of the activity here noticed, though the crookedness of the river prevents the array of factories and warehouses on its banks from being visible so plainly as they otherwise would be.

Proceeding westward from Briggate, past one of the cloth-halls (of which more hereafter), we arrive at a western suburb of Leeds called Bean Ing, where is situated the larger of the two factories of Messrs. Gott. It is an immense pile of buildings, comprising one quadrangle behind another, and both surrounded on every side by long ranges of workshops, warehouses, &c. But before reaching the factory itself, we pass by a pair of folding-gates, giving entrance to a large plot of ground presenting a twofold interest, both from the purpose to which it is now applied, and from the improvements which it indicates in the mode of manufacture. This ground was formerly occupied as a *tenter-field*, where the woollen cloth, in various stages of its manufacture, was suspended by hooks on rails to dry. But the custom became introduced, by degrees, of drying the cloth in close rooms or galleries heated by steam or by hot air; and this has been found in various ways so much more efficacious, that the old system of tenting is no longer acted on in large establishments. The tenter-ground thus set at liberty has been laid out in a series of gardens for the workmen in the factory, and thus presents a most pleasant and healthful boundary to the factory on the eastern side. The extent of ground thus laid out is about eight acres, divided into a hundred and forty-two allotments of nearly equal size. Such of the workmen as take an interest in gardening are allowed to cultivate these little allotments, paying a trifling sum in the form of rent, not as a source of profit to the proprietors, but to give the men an undisputed right to the produce which they may have cultivated. Nearly all the allotments are in a flourishing and healthy condition, each one staked off, separated from the others, and numbered, and each one serving to denote the kind of produce which its cultivator chooses to select. Some contain flowers chiefly; while others (and these more generally) contain such culinary vegetables as potatoes, cabbages, lettuces, onions, &c. The family of one of the workmen reside in a kind of lodge near the entrance, and to this family the care of the garden is entrusted. Opposite the lodge is a tool-house, where, on hooks and rails properly numbered, hang all the gardening tools, such as spades, hoes, rakes, and so forth, each renter having his own tools. In this tool-house is a board inscribed with the 'Rules and Regulations' which the proprietors have established for the good management of the garden: such as the hours during which the workmen and their families may have access to the garden, the admission of the friends of the workmen, and other arrangements of a similar character. In a busy town such as Leeds, where houses and factories are necessarily congregated very thickly, the existence of a plot of garden ground in such a situation is important in respect to the health of those who live near, independent of the good effects likely to result from the maintenance of these kindly relations between masters and workmen.

Withinside the first quadrangle of the factory is a porter's lodge, in which there is an arrangement which serves to illustrate the regularity and system observable in such large establishments. Fixed up against the wall is a shallow recess, closed by doors;

and when these doors are unlocked, the recess exhibits to view about a hundred and forty keys, hanging on as many hooks; the whole classified in twenty-six departments, and all the keys in each department numbered. All these keys belong to the various ranges and rooms of the factory; and a well-arranged system of rules is adopted as to the use and custody of them. Another little arrangement of a protective character, such as is often to be met with in large establishments, is a kind of tell-tale clock, so constructed as to show whether the watchman or guard has been at his post during certain stated intervals in the night.

When we arrive within the first quadrangle, we find an open area surrounded by brick buildings. On the north is a long range of wool warehouses, five stories in height, and extending the whole breadth of the premises from east to west. The principal work-ranges are surrounding the inner or southern quadrangle; where one long pile is occupied by a number of men engaged in various handicraft employments connected with the manufacture, another by the machines in which the wool is prepared for spinning, another by the spinning machinery, and others for the weaving, the fulling, the drying, the dyeing, and the numerous processes connected with the finishing of cloth. There are also various subsidiary buildings, such as an engine-house with two eighty horse-power engines, a room in which the logwood used for dyeing is cut up by two powerful machines into small fragments, an engineering shop for the repair of the machinery, store-rooms for the oils and dyes employed in the works, and so forth. There is a circumstance connected with the steam-boilers and furnaces which is worthy of notice as illustrating a subject in which the town of Leeds has taken an honourable precedence before most other towns, viz. the attempts to consume the smoke, or rather to prevent its formation. Much has been done at Leeds within the last few years to lessen the nuisance of smoke; and the arrangements at the factory under notice exemplify one of the modes of procedure. In the furnace-room each furnace has a thick piece of glass in front, through which the upper part of the fire-chamber can be seen. On a lower level is a kind of pump, with a handle regulated by a weight; and this pump is made to open a valve which admits air into the fire in exact proportion to the fuel used, determined by the experience of the furnace-man. Smoke is simply unburned coal, and is produced through a want of due proportion in the quantity of air admitted to the burning fuel, and to the mode of admission; and the mode of adjusting this supply is so far successful in the present instance, that there is but little smoke rising from the chimney connected with the furnaces to which this apparatus is adjusted.

The general arrangements of the factory, and the nature of the processes carried on therein, may perhaps be best illustrated by selecting a piece of fine blue or black cloth as an example, and following it through its various stages of progress; it being at the same time understood that all the varieties of woollen cloth result from various modifications of some or all of these processes.

First, of the crude wool. The wool of English sheep is not now much used for broad-cloth; it being more adapted for the production of stuffs, camlets, and the different articles coming under the denomination of 'worsted.' In proportion as the sheep is improved in flesh, so does its wool acquire a quality unsuited for the purposes of the woollen-manufacturer; and as soon as the import duty on foreign wool was so far lowered as to lead to extensive dealings, our woollen manufacturers began to use a larger and larger proportion of foreign wool, until at length it forms by far the greater portion of that employed. Formerly the

Spanish wool was regarded as the finest, and all our best cloth was made from it; but the Spanish sheep being introduced into Saxony and other parts of Germany, the German wool has gradually driven most of the Spanish wool out of the English market. More recently, however, Australia has established a new source of supply, and the wool thence obtained, in respect both of quality and price, is so advantageous to the clothier, that every year witnesses an enormous increase in the quantity imported. We may perhaps state in a general way, that at present our worsted fabrics are made mostly from English wool, our finest woollens mostly from German wool, and the large bulk of our woollens mostly from Australian wool.

The wool is brought to the factory in packages of various shapes and sizes, some almost a cube of three or four feet, some in bags not much less than twelve feet long, and others intermediate between the two forms. Each fleece (comprising the wool from one sheep) of foreign wool weighs from two to two and a half pounds; the coarser English fleece, adapted for hosiery or the worsted trade, weighing sometimes six or eight pounds. Generally the foreign wools are tied up in small bundles of three or four fleeces each, and these bundles made up into packs. When one of the packs of wool is opened, the locks are found to be all entangled together in a confused mass; and they have to be separated and somewhat loosened before any further process can be commenced. But the workman into whose hands the wool first passes has something more to do than merely separate the locks; he has to sort the wool into parcels of different qualities, a process involving very great nicety. Not only do fleeces differ one from another, but different parts of the same fleece present qualities of wool widely diverse; and as these different qualities are appropriate to the production of different kinds of cloth, the preparatory sorting is an important affair. The fingers of the sorter acquire by practice an extraordinary degree of sensitiveness, by which different qualities of fibre, quite unappreciable by others, are at once detected by him. He stands in front of a bench or frame covered with a wire grating, on which he places the wool, and, working nimbly with his two hands, he separates the wool into six, eight, ten, or sometimes as many as fifteen different kinds. It is not mere fineness of fibre which the sorter regards: he takes cognizance of softness, strength, colour, cleanness, and regularity, and regulates his subdivision by all of these qualities. It is said that if the wool-sorter be out of practice for any considerable time, his fingers lose the delicacy of touch indispensable to his occupation. The dust and loose fibres which are shaken from the wool during the sorting fall through the grating into a receptacle beneath, and are thence removed to be sold as manure.

The wool, thus separated into parcels, is scoured or washed in a hot alkaline liquor, as a means of removing some of the grease which it retains from the sheep. In the lower part of one of the buildings are all the necessary appendages of coppers, boilers, vats, and other vessels for both scouring the wool and the cloth and for dyeing. With respect to the dyeing, a difference is observable between cotton goods on the one hand, and woollen or worsted goods on the other. Cotton goods are never dyed in the state of cotton wool; the cotton being dyed, if dyed at all, either after spinning or after weaving. But woollen or worsted goods are never made from wool dyed in the state of yarn, that is, after spinning, but before weaving; the wool being always dyed either in the state of wool, before spinning, or after being woven. This gives rise to the distinction between 'wool-dyed' cloth and 'piece-

dyed' cloth, each kind possessing its own peculiar advantages, and each giving employment to a particular market or cloth-hall at Leeds. If the cloth is dyed in the wool, the dyed wool, before undergoing any other process, is laid on a table, and women pick out by hand any small fragments of dye-wood or other impurity which may be mixed up with it.

The first process, by which the locks of wool are dissected, and the fibres loosened one from another, is that which is effected by a machine called a *willy*, or, more equivocally, by the name of a '*devil*.' This willy or devil differs much in shape in different factories; but it is always a kind of hollow receptacle, in the inside of which are a number of sharp teeth, which catch into the locks of wool while revolving within the machine, and tear them open fibre from fibre. In the part of the factory where this process is carried on, a large heap of wool may be seen lying on the floor, where a man or boy sprinkles it with oil as a means of rendering it softer and more easy to work. Some kinds of wool require wilying more than once; while other kinds are sufficiently fine to be separated by one such process.

We next follow the oiled wool into a large range of buildings containing the machines which prepare the wool for spinning. Here the clatter of wheels, shafts, and other mechanical appliances, reminds us that we have entered upon that class of operations by which the factory system is most strikingly distinguished from the handicraft system of manufacture. Here machines do the work, and children have the requisite skill for tending the machines; the fingers, certainly, soiled by the oily state of the wool, but the countenances indicating nothing like unhealthiness in the nature of the occupation. The processes which these machines perform are of three kinds, two of them somewhat analogous in character, but the third totally different from either. Of these three, viz. the *scribbling-machine*, the *carding-machine*, and the *slubbing-machine*, the first acts in the following way:—There are several cylinders, on the surfaces of which innumerable wires or points are fixed, bent in determinate directions. These cylinders are so adjusted with regard one to another, that the teeth of one cylinder, while rotating, come nearly in contact with those of the cylinder nearest to it. This being the arrangement, a girl takes the oiled wool by handfuls from a basket, lays it on an endless apron at one end of the machine, and spreads it as equally as she can over a given surface. By the motion of this apron the wool is carried towards the first cylinder, where it is caught by the teeth, and carried round till brought within the action of the second cylinder, which tears it from the first; and so on from one cylinder to another, the teeth of each cylinder removing it from those of the next preceding one. The consequence of this transfer is, that every fibre becomes separated from the adjoining one, and the wool falls from the last cylinder in the state of a light, flocculent, downy layer.

Without leaving the room or shop, this downy layer of wool is next transferred to the *carding-machine*, where it is made to assume a different form. A girl, called the '*carder-filler*,' weighs the wool, and puts a certain weight of it on a given area of the endless or feeding apron. The proportion between weight and area depends on the quality of the cloth to be made or the thickness of the yarn to be spun; and much nicety is required in laying the wool equally on all parts of the surface, the fingers of the girl acquiring by practice a delicacy of touch somewhat analogous to that noticed in respect to the wool-sorter. The layer of downy wool, after being laid on the feeding-cloth, is drawn towards a range of cylinders, as in the case of the *scribbling-machine*, and these cylinders are in like

manner provided with teeth or wires. The wool is first carded or combed out till the fibres lie pretty nearly parallel; and a delicate band or sheet of this carded wool, about thirty inches long by six inches wide, is detached from the rest, and rolled up into the form of a pipe or rod, from a quarter to half an inch in diameter, and as long as the detached sheet of wool. The mechanical arrangements by which this rolling-up of the wool is effected are exceedingly ingenious, and the pipe of wool itself is not less worthy of notice; for we find, on close inspection, that the fibres do not lie longitudinally, but spread out pretty nearly at right angles to the length of the piece. This is a result of the peculiar way in which the roll or pipe is made, and is produced as a means of making the fibres interlace among each other more readily in the process of *fulling*, no such condition being given to the fibres in the production of yarn for *worsted* work, where fulling is not required.

Next we come to the *slubbing-machine*, or *slubbing-billy*, as it is more frequently called in the odd language of the workmen. At this machine the pipes or 'cardings' of wool are joined end to end, and reduced in thickness to an average of perhaps one tenth or twelfth part of an inch. Some years ago public attention was directed to the circumstance that great cruelty was alleged to have been suffered by the children attending these machines in the woollen districts, they being occasionally beaten by the men with the 'billy-roller,' a part of the slubbing-machine. When the matter was investigated, it was found that the children were hired and paid by the men who worked these machines, and that these latter proved often to be hard task-masters. Since then, this source of abuse has been remedied, and all factory arrangements have been placed on a better footing, partly by the masters themselves, and partly by the operation of the Factory Acts. But to return to the slubbing-machine: a sloping apron or feeding-cloth forms one end of the machine, which is generally placed near the carding-machines; and on this cloth the children place the rolls or 'cardings' of wool, placing them parallel, with one end of each hanging down. The remaining parts of the machine consist of machinery for catching each of these cardings at one end, drawing out a small portion, elongating that small portion to many times its original length, imparting a slight twist to the portion thus elongated, winding the 'slubbing' or soft twist on a spindle, and then treating in a similar way another similar portion of each carding. A whole row of cardings are thus worked at the same time; and as each carding is gradually drawn up into the machine, the children attach new cardings to the ends of the former ones, causing them to cohere slightly by a very light rolling and pressing. In this way the children take care to piece (from which occupation they derive their name of 'pieceners') all the cardings in turn; so that each bobbin or spindle becomes filled with a continuous line of 'slubbing,' one ounce of wool yielding from one to two hundred yards of slubbing.

The wool has now reached that state when it is ready to be spun into yarn for the weaver. This is done by those large and beautiful contrivances known as '*mule-spinning machine*,' by which the slubbing is first drawn out to a state of great tenuity, and then spun into yarn. So far as regards the principle involved in this process, it may be regarded as a repetition of the process of slubbing; for in both cases the wool is attenuated beyond its former state, and then spun or twisted. The 'spinning-mules' are about thirty feet long, and each has between two and three hundred spindles, so as to spin an equal number of threads at once.

We have thus traced the wool to the state of spun yarn, and have next to follow its course to the weaver's

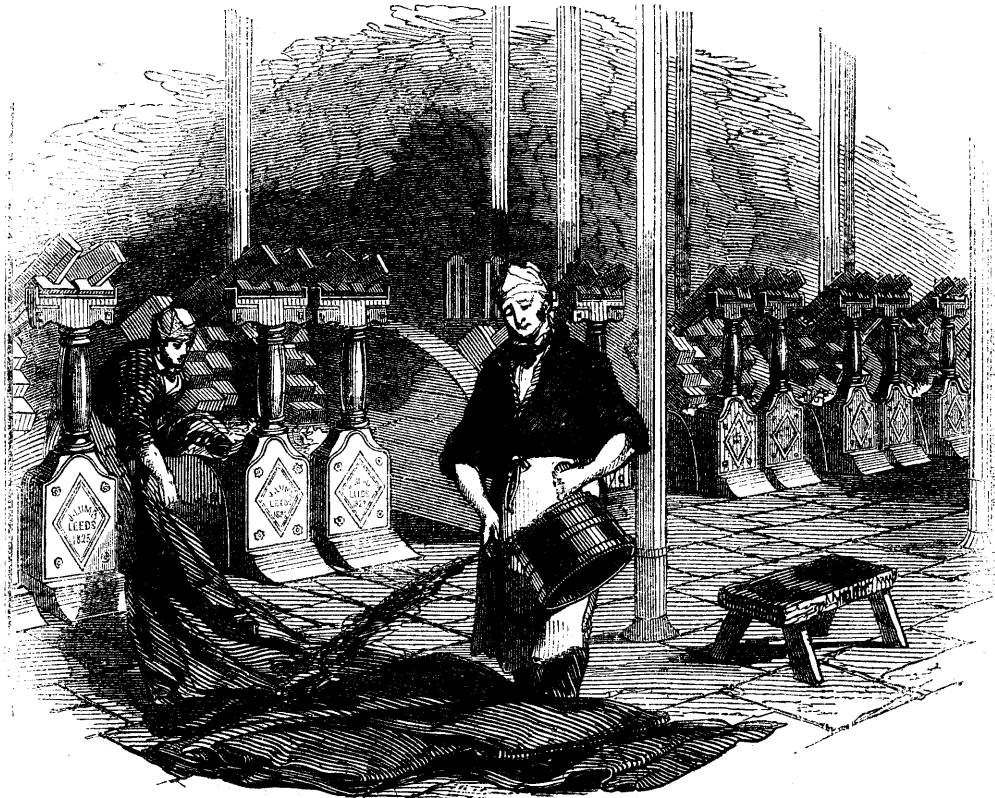
hands. Some of the yarn is for *warp*, or long threads; the rest for *weft*, or cross threads; and each kind is spun in a particular way, best calculated for the service which it is to render. Some of the yarn is stiffened by immersion in a vessel of warm size made of parchment or leather cuttings. Next succeed the various processes of 'winding,' 'warping,' 'beaming,' 'drawing in,' &c.; by which the yarn is arranged in the proper position for being used by the weaver, the warp attached to the loom, and the weft attached to the shuttle. Most of these preparatory operations have gradually undergone some improvements or other; the warper, for instance, no longer

" strains the warp
Along the garden walk, or highway side,
Smoothing each thread:"

but uses either a warping-frame or a warping-mill to facilitate his proceedings. The preparations being completed, the process of weaving is conducted much in the same way as any other kind of fabric, the looms presenting no peculiarity of construction, except in respect to the large size of those required for weaving the broadest cloth. It may seem remarkable, that while steam-power weaving is making such rapid strides in the cotton manufacture, it has hitherto been but little introduced in the weaving of woollen cloth; yet such is the case. Cloth-weaving has always been deemed among the higher branches of that art; inasmuch that, other things being equal, a hand-loom cloth-weaver earns more than twice as much wages as a hand-loom cotton-weaver. This results from the former being essentially *man's* work, requiring muscular power as well as manual dexterity; whereas cotton weaving can often be done by women and children, thereby lowering the standard of wages. At the present day some of the woollen factories exhibit weaving by steam-power, some by hand-power, and some by both; while all the manufacturers on the domestic system of course adopt the system of hand-weaving.

In regulating the width of the cloth, attention is paid to the remarkable shrinkage which takes place in the after processes. For instance, a piece of cloth to be sixty inches wide when finished, must be woven nearly a hundred inches wide; and the length must be adjusted in the same way. A piece of broad-cloth contains from two to four thousand threads in width, according as it may be '8-quarter,' '10-quarter,' or any other specified width and fineness.

When woven, the cloth passes through a series of processes which illustrate the difference between this branch of manufacture and those relating to cotton, silk, or linen, more remarkably than anything else. It is scoured or cleansed from the remaining oil which may yet adhere to it, and from the size which had been applied to the yarn before weaving. It is then '*milled*,' '*fulled*,' or '*felled*,' that is, beaten until the fibres of wool become so locked into each other as almost to hide the intersecting warp and weft threads. The '*fulling-stocks*,' in which this process is carried on, are hollow receptacles in which an enormous oaken hammer or stock vibrates up and down, each stock being kept in motion by machinery connected with a steam-engine. There are twenty-one of these machines in a row, all giving their ponderous blows from morning till night. The cloth is partially opened in the fulling-room; and after a quantity of liquid soap has been sprinkled on it, it is folded up into a pile and placed in the fulling-stocks. It is then beaten for a period, which may to many persons seem extraordinarily long, viz. from two to three entire days, during which it is removed five or six times to have a re-supply of soap. It is only by this long-continued action that the fibres of wool are made thoroughly to interlock; and by so doing the cloth becomes greatly thickened, shortened, and nar-



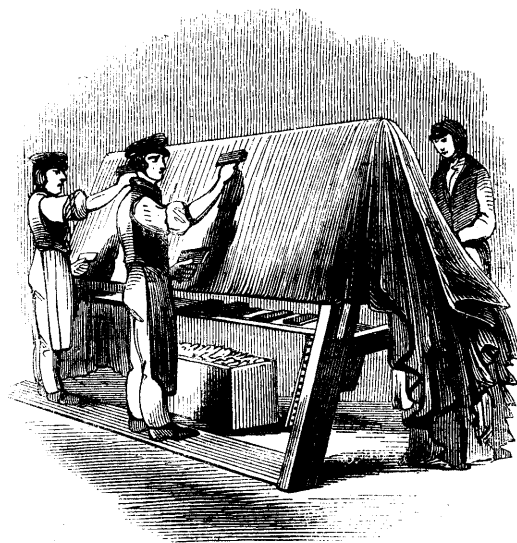
[Pulling-Stocks.]

rowed. In order that no hairs, dirt, or irregular threads may be full'd into the substance of the cloth, it is handed up to women called 'burlers' before undergoing this process of fulling. The burlers stretch out the cloth over a sloping table, and with a kind of tweezers pick out all irregular knots, burs, or hairs.

After the scouring, the fulling, and several subsequent processes, the cloth is stretched out and hung up to dry. This used to be done in the tenter-fields, where the tenter-hooks were driven into poles and rails, and the cloth hung on them by the 'list' at the edges. But in the factories there are heated rooms in which the cloth is hung up, where it speedily dries.

The cloth becomes felted into a close fabric by the process of fulling; but it is too rough and uneven at the surface to be used in that state. If the cloth is 'piece-dyed,' it undergoes that process about this stage of the operations; but whether so or not, the cloth goes through many finishing processes before being ready for use. The chief of these are *raising* and *cutting*. In the process of raising, the nap of the cloth is worked up by a brush made either of wires or of teazle-heads, and worked either by hand or by machine. In hand-raising, the workman stretches the cloth over a sloping stand, and rubs it hard with a kind of wire-brush, held like a curry-comb. In machine-raising, the wires, or more frequently teazle-heads, are fixed to the surfaces of cylinders in machines called 'gig-mills,' and the cloth, by passing over these revolving cylinders, has the nap raised up into a very rough surface. There are many modes of effecting this 'raising,' but in all the principle is nearly the same. The use of teazle-heads is a remarkable feature in the process; for no combination of wires has yet been found that will effect the required object so efficiently as the little elastic prickles on the surface of these teazles. What these teazles are, and whence they are procured, may

be seen by referring to our No. 20. They are brought to the factory in bundles, and are prepared for use by a man and a boy. The boy cuts off part of the stalks with a pair of scissors, and the man fixes the teazles



[Hand-Raising.]

into oblong iron frames, which frames are afterwards to be fitted to the surfaces of the cylinders. The little elastic hooks become from time to time filled with wool, and require to be cleansed by means of a revolving brush applied to them.

The nap of the cloth being thus raised, it is 'cut,' or



[Cutting and fixing the Teazles.]

'cropped,' or 'sheared,' so as to produce an even surface. This used formerly to be always done by hand, the workman using shears with very long blades, and working over the whole surface of the cloth with a dexterity which nothing but long practice could impart. But by degrees various machines have been introduced for effecting this much more expeditiously, and the hand-shears are now but little used. The most generally employed form of cropping-machine is a spiral cutter working against a long straight blade, the spiral cutter being made to revolve rapidly, and the cloth being drawn between the two.

According to the quality of the cloth, so is it raised and cropped more than once, so as to produce varying degrees of fineness of surface. There are also a number of minor processes, all calculated to give an improved surface to the cloth: such as 'boiling' it, to impart a certain lustre; 'burling' or 'picking' it, to remove little imperfections; 'inking' any little white hairs or fibres which may occur in the dyed cloth; 'pressing' it between hot iron plates and smooth mill-board; 'steaming' and passing the cloth over cylinders covered either with brushes or a kind of plush, &c. All these processes are carried on in distinct parts of the factory, and require an extent of arrangement which a stranger at first thought would scarcely suppose—the *plate-room*, for instance, where the iron plates for pressing are heated in a large room containing six ovens for that purpose, each capable of heating several plates at one time, and each plate weighing as much as sixty-three pounds.

We have followed out the routine of processes pretty continuously, as a means of showing the relative connection of the whole in the arrangements of a large cloth-factory; but we must find a little room to notice some of the remarkable points accompanying the domestic system of manufacture.

In some cases a manufacturer—midway as to position between a factory owner and a domestic clothier—has the wool prepared for spinning in his own establishment, or in a mill, and then gives it out to the cottagers to spin and weave. In other cases, exem-

plified in many of the villages west and south of Leeds, the domestic clothier purchases his wool, mixes and assort it according to the kind of cloth which he wishes to make, and sends it to a mill to be 'scribed,' 'carded,' and 'slubbed.' If this mill be a 'company-mill,' that is, one owned by an association of small manufacturers, the work is conducted by a manager appointed by the owners, each one pays at a certain rate for the work done for him, and at the end of the year the profits are divided. The 'slubbed' wool is taken from the mill to the house of the clothier, there to be spun, wound, warped, and beamed, the clothier either working himself or superintending the working of others, according to his circumstances in life. When the cloth is woven, he sends it to the mill a second time, there to be 'scoured' and 'fulled,' and in this state he sells it, leaving the 'raising,' 'cropping,' and 'finishing,' together with the dyeing, if sold in the undyed state, to be done by the purchaser. The mill so used, however, may be the property of another person, who prepares the wool for the clothiers. Such is the case in respect to Armley Mill, one belonging to the same proprietors as the large establishment which we have just described. This mill is situated on the river Aire, quite beyond the smoke and bustle of Leeds, and its machinery is worked by two large water-wheels moved by the stream. In this mill are contained all the machines and arrangements for working the wool *before* the spinning and *after* the weaving; that is, for wilying, scribbling, carding, and slubbing, and afterwards scouring and fulling. The clothiers send their wool dyed or undyed, as they think best, to the mill, where it is prepared for spinning; then the spinning and weaving are done by the clothiers and their families; and, lastly, the scouring and fulling are done at the mill, preparatory to the sale at the cloth-halls.

To these cloth-halls we may next direct our attention. The domestic clothiers do not keep shops or warehouses, nor are there agents from the purchasers going from house to house through the villages, nor are there cloth-fairs or markets held in the villages. The clothiers,

every Tuesday and Saturday (which are the cloth-market days at Leeds, to which we may here confine our attention) attend at one or other of the two cloth-halls, and there meet the parties who may be disposed to purchase. The original market for woollen cloth was held on Leeds Bridge, a spot selected probably on account of its publicity; but it must have been a strange and most inconvenient arrangement, with the pack-horses and stalls blocking up the way. In 1684 the market was removed farther north, to the main street of Briggate. It was held early in the morning, and was closed by the ringing of the bell at the old chapel on the bridge; and as soon as the goods and benches were removed, the place was occupied by the country linen-draper and shoemakers. This system continued till 1711, when the first cloth-hall was built. In 1755 a second hall superseded the first; and in 1758 and 1775 were built the two halls which have ever since been used as cloth-markets, and in which more cloth has probably been sold than at any other market-halls in the kingdom, or perhaps in the world. From Dyer's description, it would appear that a century ago barges on the river Aire, and laden pack-horses, were the means of carrying the cloth to and from market:—

“Trade and business guide the living scene,
Roll the full cars adown the winding Aire;
Load the slow-sailing barges, pile the pack
On the long tinkling train of slow-pac'd steeds.”

The “Coloured Cloth-Hall,” situated near the commercial buildings in the western part of Leeds, is a quadrangular brick building, inclosing an open area 360 feet long by 200 broad. It is divided into six departments, arcades, or streets, which receive distinctive names, such as “Change Alley,” “Cheapside,” &c. Each avenue contains two rows of stalls or stands, each stall measuring about two feet in width, and marked with the name of the person who rents or owns it, and who is always a country clothier. There are nearly two thousand of these stalls, each stall having behind it an open space where the clothier may deposit his stock of cloth, and the stall itself consisting simply of a small counter on which the cloth is to be displayed.

Such being the arrangement of the hall, the mode of conducting the traffic is as follows:—At a determinate hour on the mornings of Tuesdays and Saturdays, varying from half-past eight to half-past nine, according to the season, the hall is opened, and the country clothiers bring the cloth which they have for sale, mostly in carts. This cloth has been dyed in the wool, prepared, spun, woven, and fulled, but not sheared or finished. Each clothier knows his own stand, places himself with his goods behind it, and waits for customers. Some of these clothiers are men of considerable property, while others are in comparatively humble circumstances; but there is a kind of homely intelligence, an honest plainness, in the appearance of all. So much for the *sellers*. The *buyers* are either merchants who have no manufactories of their own, or persons who combine the characters of merchants and manufacturers. In the latter case, when the undressed cloth is purchased, the buyer finishes it in his own factory, and then consigns it to the woollen-draper, shippers, or factors; but in the former case, the merchant who buys the undressed cloth sends it to a mill or factory to be finished, and then receives it back to his warehouse.

The purchasers at the hall are sometimes the merchants themselves, and at other times experienced persons in their establishments who are intrusted with the important office of ‘buyer;’ but in both cases the mode of proceeding is alike. The buyers go to the hall as soon as business commences, and walk through the ‘streets’ or avenues, looking at the cloth exposed on

the stalls at either side. All the sellers know all the buyers, and each buyer is invited as he passes along to look at some ‘olives’ or ‘browns,’ or ‘pilots,’ or ‘6-quarters’ or ‘8-quarters;’ and the buyer decides in a wonderfully short space of time whether it will answer his purpose to purchase or not. “Mr. N., just look at these olives!” “How much?” “Six-and-eight.” “Too high.” Mr. N. walks on, and perhaps a neighbouring clothier draws his attention to a piece or ‘end’ of cloth (an ‘end’ being a technical name for about twenty-five yards of cloth). “What’s this?” “Five-and-three.” “Too low.” The “too high,” as may be supposed, relates to the price per yard; whereas the “too low” means that the quality of the cloth is lower than the purchaser requires. Another seller accosts him with—“Will this suit you, Mr. N.?” “Any English in it?” “Not much; it is nearly all foreign;” a question and answer which exemplify the disfavour into which English wool has fallen in the cloth trade. As Mr. N. proceeds, three or four clothiers call to him at once, or perhaps he has an entry in his book which leads him to ask for a particular kind of cloth; and he then goes from one stall to another till he meets with it. The clothier may ask perhaps two-pence or four-pence per yard more than the buyer would like to give; and in such cases a bargain is generally struck at an intermediate price, though the clothier frequently adheres resolutely to his original price. When the bargain is concluded, which may be for all, or for only a part of the cloth, the purchaser writes with a red pencil a few marks on the corner of the cloth, and walks away. This kind of traffic continues for one hour and a quarter, at which time the hall is closed, after business to the amount of many thousands has been transacted.

Immediately on the closing of the “Coloured-Cloth Hall,” the “White Cloth Hall,” situated in a more eastern part of Leeds, is opened; and the buyers generally proceed from the one to the other, unless the buyers of dyed cloth do not want to purchase any undyed cloth, or *vice versa*. This White-Cloth Hall is rather smaller than the other, but is arranged on a similar plan, and the business is similarly conducted. The undyed woollen cloth has a yellowish white colour, and is afterwards dyed according to the purposes to which it is to be applied.

When the buyer has made his purchases, he proceeds to the warehouse belonging to himself or his employers; and soon afterwards the clothiers from whom he may have purchased arrive with the cloth. Every ‘piece’ or ‘end’ is first measured, and the length, width, price, and name of the seller entered in a book by a clerk. The cloth is then taken into another room, and examined from end to end, one person looking at it by a strong light from a window, and another looking through it from behind; and there is a certain scale of allowances agreed on for any defects which may be found. When the measuring and the inspection are completed, the clothiers at once receive payment, and depart to buy wool for a new supply of cloth. In many of the large firms cloth is not only made throughout in factories, but purchases are also largely made at the cloth-halls. Such is the case with respect to the firm to whose kindness we are indebted on the present occasion; at a third large establishment, in the northern part of Leeds, all the arrangements are conducted respecting the inspection, payment, and warehousing of the cloth purchased at the two cloth-halls; and the cloth so purchased is afterwards finished at the factory farther southward.