

WOOLLEN MANUFACTURE.

WOOLLEN MANUFACTURE, *Progress of the.* The origin of the woollen manufacture, like that of many other useful arts, is not precisely known. At a very early period, domestic sheep were extensively spread over Western Asia. The introduction of sheep into Europe is not recorded by ancient writers, unless we suppose the expedition of the Argonauts to Colchis refers to this event. Sheep were probably first domesticated for their milk, and afterwards for their skins, which must have been the first dress of pastoral nations. Sheep and goats, in the early ages of society, were nearly of equal value. The Greeks, who ostentatiously refer all useful discoveries to their own country, and rank their inventors among the gods, have ascribed to Minerva the invention of spinning and weaving. These arts appear, however, to have been first practised, at a very early period, in Egypt, and applied to the spinning and weaving of flax. At what time they were first applied to wool is unknown. Though Pliny informs us, that Nicias of Megara discovered the art of fulling cloth, the property which wool possessed of felting was known in the East at a much earlier period, and probably gave rise to the first manufacture of woollen goods which were not woven, but felted like the substance of hats.

On this subject, Mr. Luccock, in his *Treatise on Wool*, judiciously remarks, " whilst the skins of sheep dressed with their wool on served as clothing, it is obvious that only one useful fleece could be obtained from one animal, and as the fleece is generally cast, or falls off once a year, this produce must have been wasted. In a very early period, however, the property which wool possesses of felting was discovered, or, in other words, it was found that by pressure and moisture the fibres of wool might be made to adhere together, and produce a compact pliable substance, quite as durable and more convenient than the skins formerly used. This appears to have been the first effort to produce a woollen manufacture." It is probable the felting property was discovered by accident, as some fleeces will felt upon the sheep's backs; among farmers, these are called cotted fleeces. When the application of this discovery was first made, the knowledge of the art was soon widely spread. The tents of the Arabs and Tartars are, at the present day, all made of felt from the wool of sheep, mingled with the hair of goats, camels, and other quadrupeds, and may be considered as remains of the original art of cloth-making.

The art of spinning and weaving threads made from wool was, in all probability, derived from the East; they are alluded to by Moses as existing nearly fifteen hundred years before the Christian era, and it appears that the early patriarchs had numerous flocks of sheep.

The greater part of these sheep, we are informed, were, at first, either dark-coloured or spotted; hence we may infer that the art of dyeing wool was then unknown. When the selection and cultivation of white wool gave to woollen cloth the property of receiving the tints of the dyer, the value and use of wool must have greatly increased, owing to the great estimation in which richly-coloured garments are held by people advancing to a state of civilization.

Thus, in addition to the superior pliability and comfort of woollen cloth, compared with skins or felts, the taste for it must have been widely spread by the art of dyeing. It had also the great recommendation to its general adoption, that it could be fabricated with ease in every family. The machinery required for the purpose was extremely simple. The distaff and the loom, says Mr. Luccock, were little more in the hands of the first manufacturers, than the spade in those of the husbandman. Spinning and weaving, as we have already observed, were in use at least fifteen hundred years before the Christian era; but the manner in which they were performed is not related until about three centuries afterwards. Then the loom consisted of a frame of wood, in some respect different from the modern one, but well adapted to the same purposes.

The alterations which have been made in it consist, perhaps, more in the position of the beam, and the mode of opening the web for the passage of the shuttle, than in any other circumstance. Nor was the earliest mode of spinning less perfect, than that which was practised in the most celebrated manufacturing countries for many ages afterwards. It was performed by means of a rod or staff, about which the wool to be spun was carefully wrapt, and held in the left-hand, while a rough kind of spindle, quickly twirled between the right-hand and the thigh, was suffered to continue its motion when suspended by the thread which the artist gradually lengthened with his fingers. This least complex of spinning-machines is not entirely laid aside even now. A few years since it was not uncommon in the county of Norfolk, and its continuance in use through so many ages is the best proof of its excellence.

The preparing of wool for spinning was probably first effected by the fingers, and afterwards by the fuller's teazle or thistle, the *diplicus fullorum*, which with its rough and hooked points was well adapted to the purpose, and has continued in use to the present day. The card afterwards used was probably a substitute for the *carduus*, or teazle. The application of the wheel to a spindle, or the spinning-wheel, is, we believe, unnoticed in history. Whenever these inventions took place, it is probable their first introduction contributed more to increase the quantity, than improve the quality of the yarn and cloth. For a considerable period after the commencement of the woollen manufacture, the improvements made in spinning or weaving of wool were effected by the improved address and skill of the manufacturer, rather than by any alteration in his machinery, as we now see the manufacturing nations of the East execute very elaborate works with instruments of the most simple construction. In proportion as luxury and refinement increased, the demand for superior fabrics would induce the growers of wool to pay great attention to the fleece, and to select and preserve for breeding those sheep which produced the softest and finest wool; with the ancients these terms were synonymous. The produce of fine white wool from sheep is entirely the result of cultivation; it has never been grown except in countries where the woollen manufactures have flourished. The race of fine-woolled sheep has, however, been partly preserved in those countries after the destruction of their trade. The grower would also soon learn to pay particular attention to the whiteness of his fleeces, as a clear white ground is necessary for receiving the most brilliant dyes. Blue, purple, and scarlet, were the tints most admired; and though the ingredients, by means of which they were produced, are in some measure unknown, yet we have the most indubitable testimonies to their excellency, and the estimation in which they were held. To produce them in their richest
lustre,

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lustre, a selection of the wool most adapted to receive them must be made, and this would operate with great precision upon the wool-sorter's attention.

While the manufacture of wool was confined to the houses of the grower, and the business of it transacted by his domestics in a secluded state, there was less room for the stimulation and exercise of invention than in after-ages, when it became the appropriate calling of one particular part of the community, and their success depended upon the opinion which others formed of the fabric. Yet in the simplest days of Greece, it was not deemed an employment unfuitable to palaces, nor did a princess degrade her dignity by superintending the labours of the loom, the distaff, and the dyeing vat.

We have little information respecting the woollen manufactures of the Greeks and Romans, as distinct from their domestic manufactures; but large establishments were necessary for the clothing of distant armies, and for foreign commerce. That the Romans had carried the manufacture of fine woollen cloth to a high degree of perfection, is proved by a variety of circumstances, and particularly by the great attention paid to the cultivation of fine-woolled sheep, and by the high prices at which the wool and sheep were sold, as appears from the writings of Pliny, Varro, and Columella. Pliny describes two kinds of sheep: the one which grew coarse long wool, and was on this account called *hirtum* or *hirsutum*, and from its hardness and ruder treatment *colonicum* or rustic; the other breed was called *molle*, from the softness of the wool, and *generosum* or noble, from its excellence; also *pellitum*, from its being clothed with skins to protect the wool. The race is sometimes also called Tarentinum, Apulum, Calabrum Atticum, and Græcum, from the neighbourhood or district in which it chiefly lived; but what is of more importance, as shewing the origin of the fine-woolled sheep of Italy, the race is called Asianum; and, according to Pliny, a similar race existed in his time at Laodicea in Syria. The description given of these sheep by Pliny agrees with the present race of Merino sheep. There is not, says Dr. Parry, throughout Europe, any breed of short-woolled sheep now existing besides the Merino, of which the males are horned and the females not.

That the Romans imported their Tarentine sheep into their western colonies, with the art of manufacturing fine cloth, we learn from Strabo and Pliny. The former writer, who flourished in the reign of Augustus, says, that in Turdetania in Portugal, then a part of Spain, "they formerly imported many garments, but now their wool was better than that of the Coraxi, and so beautiful, that a ram for the purpose of breeding was sold for a talent, and that fabrics of extraordinary thinness were made of this wool by the Saltratæ." Probably this was similar to the shawl cloth of India, and woven in the same manner, as Pliny calls it *scutulatus*, a term which he applies also to the spider's-web. The little attic talent of silver is estimated to equal in value 216*l.* of English money, which shews the high estimation in which the best wool was held even in the colonies of Rome.

All ranks of people of both sexes among the Romans chiefly wore woollen garments. In the reign of Aurelian, 270 years after Christ, a pound of silk, according to Vopiscus, was equal to a pound of gold. A people so pre-eminent in wealth, and in all the refinements of art, would naturally be solicitous to attain the highest degree of excellence in the manufacture of those fabrics, which were calculated to gratify their passion for adorning their persons, and it was equally as necessary to consult their ease as

their vanity. The summer-heat of Italy was so great, that the affluent could scarcely have supported a woollen dress, had it not been made of the lightest and thinnest cloth. We find also, that during the Augustan age, and for a considerable time afterwards, it was the fashion to wear cloths which, as at present, were furnished with a raised nap or pile. Such cloths were called *pexæ*, in contradistinction to *tritæ* or thread-bare. Thus Horace:

"—— Si forte subucula pexæ
Trita sub est tunicæ—— rides."

"You laugh if you spy a thread-bare vest
Under a well-dressed tunic."

And also Martial:

"Pexatus pulchre, rides mea, Zoile trita."

The term *pexatus*, applied to cloth, leads us to suppose that the nap or pile was raised with a comb, having very fine teeth. Pliny informs us, that in his time the price of wool had never exceeded 100 sesterterii the libra, or pound; now the Roman sesterterius being about 8*d.* of our money, and the libra about 5245 grains, it follows that an avoirdupois pound, or 7008 grains, would have cost about 1*l.* 2*s.* of our money. From the intercourse with Persia and the East, the Romans would become acquainted with the shawl-cloths of India, and would naturally wish to imitate so beautiful and delicate a fabric. These are made from very soft fine short wool, and not from combed wool, as has been generally supposed in this country. The existence of that manufacture in Hindoostan for many ages, is a proof of the high degree of perfection to which the fabrication of woollen cloth had been carried in former times. For shawl-cloth is only woollen cloth, woven with a twill, and unmilled, but it is spun to a great degree of fineness, and from wool so peculiarly soft, that it has never been rivalled by any European nations. The perfection of the colours, and the skill displayed in the weaving, we have no reason to believe are greater now than in the time of Alexander the Great; and if these manufactures were successfully imitated by the Greeks or Romans, or even distantly approached in the manufacture of their fine cloths, we may form some idea of the perfection to which they had arrived. When in the decline of the Roman empire, their colonies were overrun by savage barbarians, all their public establishments and manufactures were destroyed, but the art of producing from the fleece a warm and substantial clothing was never entirely lost, even during the darkest days of ignorance. It began to revive, and became the separate occupation of one class of the community about the middle of the tenth century in the Low Countries, where it remained the glory of the people, and the source of their opulence, through more than four hundred years. The wool which it consumed for the first few years was the produce of their own pastures, which had but lately been reclaimed from the forest; but as the manufacture extended itself, the demands became larger, and were supplied from a greater distance. The wealth which it distributed was soon visible, and people crowded into the country, engaged in its commerce, and pushed their speculations with increasing vigour through a hundred and fifty years, when an inundation of the sea threatened to involve the art, the artist, and the country, in one general destruction. The dispersion of the people who fled from the calamity which appeared to overwhelm their hopes, instead of destroying the infant manufacture, gave it additional vigour, and was the means of establishing a connection between

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tween the Netherlands and foreign countries, which proved of the highest importance to commerce. It contributed to a much more speedy recovery of the arts connected with the woollen manufacture, from the ruin which seemed to threaten them, and gave a striking instance of their partiality for the seats where they have once flourished, under the patronage of a government liberal enough to encourage, and sufficiently powerful to protect them, even in situations attended with natural disadvantages. The influence of these manufactures upon the fleeces of the Low Countries must have been very considerable; for before the year 960 we have no reason to suppose that their quality was superior to that which we find in the neighbouring districts; yet it was not very long ere Flanders and Brabant became famous for the manufacture of fine cloths, even at a period when they imported but little foreign wool. Perhaps the fabrics might not be equal to those which we now produce from the fleeces of Spain, or even from the improved ones of our own sheep, but they were preferable to those of England and the nations of the continent, Italy and Spain excepted. It was about the year 1200 that the merchants began to import the wools of other countries, to extend their connections much more widely, and to grow by this means still more rich and powerful. The manufactures required a larger quantity of the raw material than usual, and the population of the country had reached that extent which does not admit of a great number of sheep being kept, even though the employment of the people depend upon the fleeces, and their subsistence upon the food which they furnish. We shall observe instances of a similar kind when we treat more particularly of England. The operation of these two causes was evidently sufficient to induce the manufacturer to go farther from home, and to seek the most convenient methods of supplying his looms. It might have been expected that he would have turned his attention to France and to Germany; but independent of the hostile dispositions of some of the neighbouring sovereigns, the raw material was too bulky to be conveyed at an easy expence through the bad roads of a half cultivated country; and the ships of Spain and of Britain, who found an interest in supplying the wants of the Netherlands, unladed their cargoes almost at his very door, and solicited in payment but little else than the goods which he had manufactured.

Spain was the first country on the western side of Europe, where the Tarentine breed of fine-woolled sheep were cultivated with success by the Romans. See SHEEP.

This breed, intermixed with the native flocks, gave rise to the present fine-woolled sheep of Spain; and it does not appear that this valuable race was ever greatly neglected in that country. That it abounded in sheep in what is called the middle age cannot be doubted. At the period when the Saracens extended themselves in Spain, about the eighth century, to use the quaint words of Roderic, archbishop of Toledo, "it was fruitful in corn, pleasant in fruits, delicious in fishes, favourable in milk, clamorous in hunting, and gluttonous in herds and flocks,"—*gulosæ armentis et gregibus*. He wrote in A.D. 1243. In England at that time sheep were so scarce, that a fleece was estimated at two-thirds the value of the ewe which produced it, together with the lamb.

Into Spain the invaders either carried the arts of luxury, or, what is more probable, improved them by their superior industry. The revenue of one of their sovereigns in the tenth century amounted to six millions sterling; a sum, says Gibbon, which at that time probably surpassed the united revenues of the Christian monarchs. When, several centuries afterwards, the Saracens were gradually expelled by their

Christian neighbours, Spain saw nothing but the change of religion to compensate the loss of population, of agricultural and mechanical science, of industry, and wealth. On the recovery of the Seville from the Moors in 1248, not less than 16,000 looms are said to have been found in that city. Of these, the greater number was probably employed in the fabric of woollen cloths. According to Uftarix, "Theory and Practice of Commerce," the manufactures of Segovia flourished most, both in point of number and quality, and were in high esteem, being the best and finest that were known in ancient times. The temperature of the climate, and the luxurious propensities of the inhabitants, would naturally determine these fabrics to be of the lightest and softest kinds. Hence in the midst of the boasted ancient manufactures of England, we read only of two or three instances of the importation of English cloth into Spain. The Spaniards had certainly at that time their own native fleeces best adapted to their own taste and climate.

We are told by Dillon, in his "History of Peter the Cruel," that the woollen cloths of Barcelona were in high esteem in Seville in the reign of that prince, and in the preceding century. So far back as 1243, the woollen cloth of Lerida is spoken of in terms of great estimation. A few years after, Bauras, Valis, Gerena, Perpignan, and Tortosa, were remarkable as manufacturing towns, and for the fineness of their cloths, fustians, and ferges. So great was their exportation, that in 1353 there were 935 bales of cloth taken on board a ship from Barcelona to Alexandria by a Genoese privateer; and 1000 bales of cloth were taken on board three Catalonian ships in 1412, by Antonio Dorco, in the port of Callus. We are told by the same author, that, according to records still extant in Barcelona, considerable orders for wool were sent to England in 1446, in order to be manufactured there and returned to England in the form of cloth, the Spaniards themselves disdain to wear it.

According to Lucius Marineus Siculus, who wrote in the time of the emperor Charles V., Spain was then full of herds and flocks, more especially it contained innumerable sheep; so that many shepherds, whom he knew, had flocks of 30,000 each; on which account Spain not only supplied its own people most abundantly, but also foreign nations, with the very softest wool.

This account is confirmed by what is related by Sandoval, who states, that in an insurrection in Spain in 1519, the army of insurgents, among whom were many cloth-workers, stipulated, among other points, that the cloths imported into Spain should be of the same size and goodness as those wrought there; and that the merchants and clothiers might have leave to seize, in order to work up, half the wools sold for exportation, paying the owners the price at which they had been bought. Hence we learn the superiority of Spanish cloth, and the great sale of Spanish wool to foreign countries at that time.

Damianus a Goes, who was page to Emanuel, king of Portugal, in 1516, has written a short account of the memorable things of Spain, which he dates at Louvain in the year 1541. In this work he says, that there are annually exported from Spain to Bruges 40,000 sacks of wool, each selling at the lowest for twenty gold ducats.

Now from an authentic acquittance, preserved in the Fœdera, from queen Elizabeth to Cosmo de Medici, for a sum borrowed by him of Henry VIII., we find that the gold ducat or florin was in 1545 equal to five shillings of our money. In this year, the 36th of Henry VIII., the base coinages began; but as queen Elizabeth seems to have continued receiving the instalments of the Florentine debt

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for several years at the same rate, when the shilling was of something more than the present value, we think it probable that the rate was fixed at the beginning of the year 1545, when the shilling was at 1*s.* 1½*d.* of our present coin. This wool was, therefore, worth at least 5*l.* 14*s.* 7*d.* the sack of 181½*lbs.*, and 11*l.* 9*s.* 2*d.* the sack of 364*lbs.*

In 1560, in the time of Guicciardini, Spanish wool in the Netherlands was at a somewhat lower price. He tells us, "that they used formerly to send annually from Spain to Bruges more than 40,000 sacks, but that in this year the Spaniards, having made more cloth at home, had sent only 25,000 sacks, at 25 crowns each." The crown being 4*s.* and the shilling 1*s.* 0¼*d.* of our money, this would be 10*l.* 1*s.* 1*d.* the sack of 364 pounds. The depreciation seems in truth to have arisen from a diminished demand for this wool in the Netherlands. The wools imported into the Netherlands from Spain were the lower or coarser kinds.

The superfine wools of Spain seem to have been first introduced among the Italian states. Thus Damianus a Goes in 1541, after having specified the 40,000 sacks to Bruges, as before-mentioned, adds, "and also to Italy, and other cities of the Netherlands, are annually sent about 20,000 sacks, of which those used in Italy, being of the choicest wool, are sold at from forty to fifty gold ducats each."

From this account, we have a fair opportunity of drawing two important inferences: the first is, that the Spanish wool which went to the Netherlands was, as we have before observed, of the coarsest kind, being of only half the price of that which was exported to Italy; secondly, we can compare the value of the latter with that of our English wool, the best of which, according to the act of parliament in 1534, already quoted, did not in England exceed 5*s.* the stone of 14 pounds, of 6*l.* 10*s.* the sack of 364 pounds. The shilling, however, being then equal to 1*s.* 4½*d.* of our coin, increases the price of the sack 8*l.* 18*s.* 9*d.*; to which add custom and subsidy, 3*l.* 13*s.* 4*d.* or 5*l.* 0*s.* 10*d.*, and the result will be 13*l.* 19*s.* 7*d.* The additional charges of freight and merchant's profit would scarcely bring the whole amount to 16*l.* 16*s.* On the other hand, according to the testimony of Damianus a Goes, the Spanish sack of 181½ pounds was in 1541 worth 14*l.* 6*s.* 5½*d.*, and the sack of 364 pounds 28*l.* 14*s.* 6*d.* of our present money. If the author speaks only of the value of this wool in Spain itself, then a farther addition must be made of freight, merchant's profit, and probable duty to the crown. On the whole, this calculation is sufficient to shew in the strongest light the superior price of superfine Spanish wool, to that of the very best at that time produced in Britain.

Next in order of time to the Italians, the manufacture of superfine wool seems to have been adopted by the French, who, according to Guicciardini, in 1560 sent by land to Antwerp some very fine cloths of Paris and Rouen, which were highly prized.

It is probable, however, that these cloths were made only of mixed wool.

A strong confirmation of the early use of the best Spanish wool, unmixed with coarser by the Italian states, is furnished by Richelieu's Political Testament, printed in 1635, in which, speaking of the fine woollen manufactures of France, the author says, "the Turks prefer the draps de sceau de Rouen to all others, next to those of Venice, which are made of Spanish wool."

And the author of "England's Safety in Trade's Increase," written in 1641, tells us, that "the greatest part of their (the Venetians) wools from Spain, and the rest from Constantinople, is commonly brought in English shipping."

In 1646, Nicholas Cadeau and other Frenchmen had letters patent for twenty years, for making at Sedan black and coloured cloths, like those of Holland, of the finest Spanish wool.

The inhabitants of the north of Europe, as before-mentioned, were not at first able to manufacture fine Spanish wool, without the assistance of that which was longer and coarser. But what in the beginning was a matter of necessity, became afterwards an object of choice; and the more skilful clothiers, whether in Holland or elsewhere, either carding the finer and dearer Spanish with the coarser and cheaper English, or forming a warp of the latter, which they covered with a woof of the former, contrived to make a cheap and serviceable cloth, which pleased the eye equally well with the more costly fabrics of entire Spanish wool. This though generally concealed with great care at the time, yet is afterwards candidly acknowledged by writers actually engaged in the commerce of wool, and sufficiently refutes the prejudices which had here prevailed from the middle of the 16th to the middle of the 17th century. Hence it appears that our wool, when placed in connection with Spanish, was chiefly valuable from being well calculated not to improve but to adulterate it.

A treaty between France and Spain in 1659, enabled the former freely to obtain the wool of the latter, and thus to gain great advantage over us in the Levant trade. From the proximity of France to the woollen manufactures in the north of Spain, it might have been expected that the French would have earlier engaged in this manufacture; but owing to their frequent northern wars, and their attention being directed to the manufacture of silk, the French do not appear to have commenced the fabrication of woollens for exportation extensively before the 16th century. About this time, France made great progress in her manufactures of wool, and in securing the export trade, particularly that to Tartary, for which she was better situated than Holland or England.

The nature of her trade to warm climates directed her attention to the fabrication of finer and lighter cloths, than those made by her northern neighbours; in consequence of which she preserved the greater part of the Turkey trade to the period of the French revolution, and in general fine French cloths had attained a celebrity for their superiority, both in texture and dye, over those of any other country in Europe. The native breeds of sheep in France were greatly improved by intermixture with sheep imported from Spain. With these advantages, France might have nearly secured a monopoly of the finer branches of the woollen manufacture, had not the absurd policy of her rulers, in the revocation of the edict of Nantz, driven the manufacturing Protestants to other countries, where they contributed, by their exertion, their skill, connections, and capital, to form establishments which rivalled those of the country from which they were expelled.

Notwithstanding this, as France supplied the greater part of her own population of twenty millions with cloth, besides her foreign exports, we conceive that the woollens manufactured in that country, before the late revolution, equalled in quantity the cloth made in England at the time, and greatly exceeded it in value. Under the emperor Napoleon, the best Merino flocks were imported in multitudes from Spain, which have spread over the country, and are equal to supply extensively her manufactures of woollens, when they shall be again fully established. Considerable quantities of fine wool have been imported from France into England since the peace of 1815.

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The confusion attendant on a great revolution, continued for twenty years, gave so severe a blow to the manufacturing establishments of France, that a considerable time must elapse before they are completely established. Prior to this revolution, the superfine cloths of France were superior to those of England, in texture, colours, and softness. In the finer articles of worsted goods, and in the mixed worsted goods made partly with long combing-wool, and partly with silk or goat's-wool from the Levant, they surpassed the manufactures of this country; but the manufacturers of the commoner kinds of worsted goods, as tamies and shalloons, could not rival us in foreign markets for want of a proper supply of wool suited to the purpose. The following were the principal seats of the superfine and fine woollen manufactures in France, arranged according to the different qualities of the goods made at each, beginning with the finest:

1. The manufactures of Gobelins.
2. Of Sedan.
3. Of Abbeville.
4. Of Louviers.
5. Of Elbœuf.
6. Of Rouen and Darnetal.

Besides several detached manufacturing establishments of superfine cloth in Languedoc, Champagne, and other parts of France.

At the Gobelins, superfine cloths of the very first quality were manufactured; but the manufactures there were confined solely to the broadest white cloth intended to be dyed scarlet or purple, and the brightest colours from cochineal.

Sedan followed next to Gobelins for the beauty of its superfine cloths, where they were also made of various breadths and colours.

Abbeville may be placed next after Sedan: some have even supposed that it equalled Sedan in the fineness of its cloths; but this arose from the cloths of the latter place being of various sorts: the lower kinds were certainly inferior to those of Abbeville; but the quality of the greater part of the cloths of Sedan were of a better kind than the average quality of the cloths of Abbeville. In the manufactures of Sedan, each manufacturer confined himself to a particular kind of cloth, for which he became distinguished, some being celebrated for fine, and others for superfine cloths exclusively; whereas in Abbeville, Louviers, and the other districts enumerated, there were manufacturers who made various sorts, and the proportion of the fine to the superfine was greater than at Sedan.

Elbœuf was one of the most ancient seats of the woollen manufacture in France, but the quality of the cloths made there had greatly degenerated from the years 1760 to 1770; but afterwards the manufacturers returned to the former quality of their cloths, which were partly made of the fine wools from Berry, and partly from fine Spanish wool, or from a mixture of Spanish with the best wools of Berry.

Rouen and Darnetal may be placed in the sixth class of manufacturing districts of fine cloth, in which the finest wools of France were principally used, mixed with those of Spain.

The establishments for the manufacture of common cloth and coarse woollens were much more widely spread over France. The goods appear to have been principally consumed in that country to supply the demand of a population of twenty millions, and the numerous military establishments, besides what might be sent to the French colonies.

As the French never exported any considerable quantity of common or coarse woollen cloths, the manufactures of these articles never equalled in extent those of England. The circumstance of the coarse cloth manufacture being so widely spread over the country, tended also to prevent that degree of rivalry which promotes the spirit of improvement where manufactures are more concentrated; add to this, the French had not that abundant supply of the coarser clothing-wools which could enable them to rival us in the export of heavy woollen goods.

The worsted manufactures of France, including ferges and those goods made with a warp of worsted, were principally carried on in four of the provinces of France, but more extensively in Picardy than elsewhere. The long combing-wools which supplied this manufacture, were partly the produce of France, and partly imported from Holland, England, Flanders, and Germany. M. Rolland, in the French Encyclopædia, describing the French manufactures in the year 1783, soon after the American war, says, that during that war the English administration tacitly encouraged the exportation of wool to promote the interests of agriculture. He describes the French combing-wool as being coarser and more harsh than the wool of Holland, as wanting much more in the manufacture, and making goods of a very inferior quality. The combing-wools of England, though generally less found and fine, and of a less pure white, than those of Holland, were particularly well suited to some parts of the worsted manufacture.

The combing-wools from Germany were coarse and harsh, and only used in default of other supplies. Very fine worsted yarn was also obtained from Saxony and the environs of Gottingen; but this yarn was tender, and required to be mixed with worsted yarn from English or Dutch wool. The yarn of Turcoign was supposed to be Dutch, but was principally from Flanders and Artois. The goat's-wool came from the Levant, by way of Marseilles, in bales of from 200 to 300 lbs. It sold from four livres to twelve livres *per* French pound; the price of that most generally used was about 4 livres 10 sous *per* pound. The silks used in silk camelots, &c. were obtained from Paris and Lyons.

The following table gives the quantity and value of wool yarns and worsted pieces in Picardy; but he supposes the quantity to be under the real amount, the manufacturers concealing the extent of their trade to avoid arbitrary taxation.

Wool consumed in the Worsted Manufactures of Picardy.

	fous.	livres.
French wool	3200000 at 22	3520000
Dutch ditto	180000 at 40	360000
English ditto	200000 at 32	320000
German ditto	100000 at 22	110000
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	3680000	4310000

Yarn imported.

	liv. s.	liv. f.
Yarn of Turcoign	60000 at 8 10	510000
German yarn -	100000 at 7 0	700000
Levant yarn, or mohair -	220000 at 5 10	1210000
Silk used in fine worsted goods }	20000 at 35 0	700000
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Total value of wool and yarn	- -	7430000
	4 M 2	Brought

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Brought forward	7430000
Combing and spinning 3680000 lbs. of wool	4310000
Winding, warping, and weaving	4770000
Dyeing of yarn and pieces	190000
Profit of the wool-dealers, manufacturers	1300000
Total value of 1500000 pieces coming from the manufacturer	18000000
Value of dyeing-wares	500000
To which carriage and profit of the merchant and draper	2000000
Total value of worsted goods in Picardy	20500000

One million and fifty thousand pounds weight of wool were also consumed in hosiery in the same province, of which the greatest part was native; and the remainder about two hundred and fifty thousand pounds weight from Holland. The number of working manufacturers in Picardy is thus stated:

50000 men who gain 140 livres <i>per annum</i>	7000000
50000 women	3500000
150000 children	6000000

The greater part of the manufacturers resided in the country, and were employed part of the time in agriculture; this was also the case with the manufacturers in the towns, so that not more than eight months in the year were devoted to manufactures. This change of employment, so conducive to the health and comfort of the labouring classes, may be regarded as presenting the happiest form under which manufactures can be carried on. This was also in a considerable degree the situation of the woollen and worsted manufacturers in Yorkshire, before the late introduction of machinery had driven the population into large factories; a change which may be regarded as one of the greatest evils that ever afflicted civilized society, tending directly to degrade and enfeeble the human race, and to render man a wretched machine, a prisoner from the cradle to the workhouse or the grave, devoid of moral feeling and physical energy.

What was the extent of the worsted manufacture in the other provinces of France where it was carried on, we have no correct means of ascertaining. In the middle of the last century, the export of cloths and worsted goods from Languedoc alone amounted annually to about 60,000 pieces, sent to the Levant and to Barbary. At that time also, Spain, and all the countries bordering the Mediterranean, received worsted goods from France. In the variety of worsted articles, in the ingenuity of the patterns, and the superiority of the workmanship, as well as of the dyes, France may be regarded as having surpassed any other nation in Europe, prior to the year 1780, or about the close of the American revolution. Since that period, the manufactures of England have astonishingly increased, and have obtained a decided preference in foreign markets.

The woollen manufactures of Saxony and Germany have been long established; the fugitives from the edict of Nantz contributed much to improve and extend them. During the late war, all the manufactures in Germany and every part of the European continent suffered greatly, but are at present rapidly reviving, and will abridge the amount of our exports in Europe.

In Russia, Sweden, and Denmark, the woollen manufacture, as a distinct occupation, is comparatively new; yet it has existed long enough to produce great alteration

in their flocks. And as this change was attempted in a more enlightened period, and conducted by scientific men, the best means were adapted to promote the improvement, and new breeds of sheep have been introduced into both countries. The same remark applies to Saxony and other circles of the German states, and even Hungarian flocks are not without evident indication of a change for the better.

Of the worsted manufacture as distinct from the woollen, we have little information respecting its origin. It comprises all those goods made of combed wool in distinction from carded wool. We are unacquainted with the period when the wool-comb was invented, or when worsted goods were first manufactured. It is probable, that worsted goods were originally woven in the East, and that the knowledge of them was brought into Europe either by the Armenian merchants, or those who returned from the extravagant expeditions which were undertaken for the recovery of the Holy Land from the dominion of the infidels. The garments which are now worn by the Turks, some of which seem to have been produced by means of the comb, the incidental mention of that instrument in an account which we have of Angora, and the demand for worsted goods through the Levant, confirm the conjecture, and lead us to suppose, that there exist very considerable manufactures of this kind in the Turkish empire, although we know little more of its domestic and rural condition, than can be obtained from the most vague accounts and uncertain deductions. After the art of spinning worsted yarn was known in the west of Europe, the looms of the Netherlands became active in converting it into those peculiar kinds of goods to which it was adapted, and it seems as though the distinction between these and woollen articles was not generally noticed until some years afterwards. It might have been expected from the nature of the article, that the manufacture of worsted goods should in many southern countries have preceded that of cloth. Long-stapled wool suited to the comb seems more spontaneously the produce of uncultivated sheep, than short wool, which is to be manufactured by carding, and its mode of manufacture more nearly resembles that of flax; hence it is not improbable, that worsted goods were made in Egypt and the East before the manufacture of woollen cloth. This is, however, uncertain.

In the manufacture of long wool, the fibres are arranged parallel to each other, like those of flax; but before they are spun, they require to be laid even by some kind of instrument, which shall separate the fibres, that they may draw out easily in spinning. A comb of a very simple construction, with a few wires for the teeth, was probably first made use of. It was afterwards found, that the application of heat to the comb contributed more effectually to the regular arrangement of the fibres; and thus the invention of the common wool-comb arose, but at what period is unknown. Vulgar tradition ascribes the invention to bishop Blaize, who first used it in Alderney; but there does not appear any authority in support of this opinion. The bishop lived in Armenia, and was raised to the episcopal dignity about the time of Dioclesian, and suffered martyrdom under that tyrant. Before he was beheaded, he was tortured with iron combs, with which his flesh was torn; and hence when an instrument of that kind was brought into common use, the workmen chose him for their patron saint. The traditions of the origin and progress of the worsted manufacture are thus extremely imperfect; we shall have occasion to speak of its introduction and progress in this country in the following section.

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Rise and Progress of the Woollen Manufactures in England.—The Romans, as we have stated on the authority of Camden, had a cloth manufacture at Winchester. The first account of any distinct body of manufacturers afterwards occurs in the reign of Henry I., but either the people of this country were wholly clothed in skins or leather in the intervening space, or, what is more probable, coarse cloths were manufactured in a rude manner in most of the towns and villages in England. A great part, however, of the dresses of the labouring classes in the country was made of leather, particularly the breeches and waistcoats, even till the present reign. George Fox, the founder of the Quakers, in the reign of Charles I., travelled on his missions through the country, buttoned up in a leathern doublet, or waistcoat with sleeves, which supplied the place of a coat. This was not, as his adversaries afterwards affirmed, from any superstitious prejudice respecting that costume; it was the common dress of the labouring mechanics at that time, to which class he belonged.

The first account of any foreign weavers settled in England is recorded by William of Malmesbury and Giraldus Cambrensis, who relate that a number of Flemings were driven out of their own country, by an extraordinary encroachment of the sea in the time of William the Conqueror. They were well received, and first placed in the neighbourhood of Carlisle, and on the northern frontier; but not agreeing with the inhabitants, they were transplanted by Henry I. into Pembrokehire. They are said to have been skilful in the woollen manufacture, and are supposed to have first introduced it into England as a separate trade. Cloth-weavers are mentioned in the exchequer accounts as existing in various parts of England in the reign of Henry I., particularly at London and Oxford. The weavers of Lincoln and Huntingdon are represented as paying fines for their guild in the 5th of Stephen; and in the reign of Henry II. (1189), there were weavers in Oxford, York, Nottingham, Huntingdon, Lincoln, and Winchester, who all paid fines to the king for the privilege of carrying on their trade. (*Chronicon Pretiosum*, p. 64.) There were also cloth dealers in various parts of Yorkshire, Norwich, Huntingdon, Gloucester, Northampton, Nottingham, and Newcastle-upon-Tyne; also several towns in Lincolnshire, and at St. Alban's, Baldock, Berkhamstead, and Cheshamfield, who paid fines to the king that they might freely buy and sell dyed cloths. These are supposed to have been cloths imported from the Flemings. The red, scarlet, and green cloths, enumerated among the articles in the wardrobe of Henry II., were most probably foreign, as the English had attained little skill at that time in the art of dyeing. Madox's History of the Exchequer.

In the 31st of Henry II. the weavers of London received a confirmation of their guild, with all the privileges they enjoyed in the reign of Henry I.; and in the patent he directed, that if any weaver mixed Spanish wool with English in making cloth, the chief magistrate should seize and burn it. (*Stowe's Survey of London*.) This absurd edict was issued under the pretext of the inferiority of the Spanish wool, but was doubtless intended to encourage the growth of English wool, an article from which our kings derived a considerable revenue. The circumstance rather proves the superior excellence of Spanish wool at that time, and the jealousy which its importation had excited among the English wool-growers.

In the reign of Henry III. an act was passed limiting the breadth of broad-cloths, russets, &c. to two yards within the lists. In the year 1284, foreign merchants were first permitted to rent houses in London, and buy and sell their

own commodities, without any interruption from the citizens. Previous to this date they hired lodgings, and their landlords were the brokers, who sold all their goods, and received a commission upon them. It was soon after pretended that the foreign merchants used false weights, and a clamour being raised against them, twenty of them were arrested and sent to the Tower. Amidst the numerous absurd restrictions to which commerce and manufactures were subjected, we need not be surprised at the little progress which they made.

The materials which history affords respecting the woollen manufacture before the reign of Edward III. are but scanty; it appears that the office of aulnager, or cloth inspector, was very ancient. In the reign of Edward I. we are informed by Madox, that Peroult le Tayleur, who held the office of aulnager of cloth in the several fairs of the realm, having forfeited it, the king, by writ of privy seal, commanded the treasurer to let Pieres de Edmonton have it, if he were fit for it, and a writ was made out accordingly, and he took the oaths of that office before the treasurer and barons. The facts above-stated prove the existence of the cloth manufacture in England before the time of Edward III., who is generally supposed to have first introduced the art into the kingdom. There is no doubt, that a new impulse was given to it during this reign by the liberal protection granted to foreign manufactures here: in all probability, they first introduced the manufacture of stuffs from combed wool or worsteds; an art requiring more skill, and more complicated processes, than are employed in the making of cloth.

In the year 1331, John Kemp, a master manufacturer from Flanders, received a protection to establish himself here with a number of dyers and fullers to carry on his trade, and in the following year several manufacturers came over from Brabant and Zealand. It is said, that the king's marriage with the daughter of the earl of Hainault enabled him to send over emissaries without suspicion, to invite the manufacturers to this kingdom. These manufacturers were distributed over the country, at the following places:—The manufacturers of fustians (woollens) were established at Norwich, of baize at Sudbury in Suffolk, of faves and ferges at Colchester in Essex, of broad-cloths in Kent, of kerries in Devonshire, of cloth in Worcestershire and Gloucestershire, of Welsh friezes in Wales, of cloth at Kendal in Westmoreland, of coarse cloths, afterwards called Halifax cloths, in Yorkshire, of cloth in Hampshire, Berkshire, and Sussex, and of ferges at Taunton in Devonshire. (*Rymer's Fœdera*, vol. i. p. 195.) Fresh supplies of foreigners contributed to advance the woollen trade of these districts.

Kendal, in Westmoreland, claims the honour of first receiving John Kemp, where his descendants still remain, and the woollen trade is at present carried on. In the following reign, we find the manufacturers of Kendal petitioning to be relieved from the regulations imposed on broad-cloths. Kendal green is mentioned by Shakspeare as an article of dress in the time of Henry IV., and there is reason to believe, that in the reign of Elizabeth, the woollen manufactures of that town were as extensive as at present.

In the year 1336, two woollen manufacturers from Brabant settled at York, under the king's protection: they are styled in the letters of protection, "Willielmus de Brabant & Hanckcinus de Brabant, Textores." These persons probably laid the foundation of the woollen and worsted manufactures, which have since so extensively flourished in the western part of that county. It is not very improbable, that the manufacturer Hancks, called Hanckcinus,

gave

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gave the name to the skein of worsted, which is to this day called a hank.

The references which we have soon afterwards to the woollen manufacture, as existing in the districts before-named, tend to confirm the belief, that the distribution of the foreign manufacturers we have given is correct. About this time, we learn that Thomas Blanket, and other inhabitants of Bristol, set up looms in their own houses, but were so harassed by the impositions of the mayor and bailiffs of the place, that they were obliged to obtain letters from the king to permit the free use of their trade, without impediment, calumny, or exaction. The letter to the mayor and bailiffs accuses them in the following terms: "vos diversas pecuniæ summas ab eisdem Thomas et aliis exigitis et ea occasione multipliciter inquietatis et gravatis, ut afferunt." Dr. Parry has conjectured, that blanket, which at first meant a coarse white undressed cloth, derived its name from the fame Thomas Blanket of Bristol. The encouragement given to the woollen manufacturers during this reign, and the consequent consumption of wool at home, diminished the export of it so much, that a duty was laid on cloth exported to supply the place. Blackwell-hall was appointed by the mayor and common council of London for the market, where cloth manufacturers might send their goods for sale, in the year 1357.

In the course of the reign we find several other acts relating to the measurement and fulling of cloth, and the fees to be paid to the aulnager.

In order to form a more distinct idea of the relative value of wool, cloth, and other articles, after and before the reign, it may be proper to refer to the state of the silver coinage.

	Grains.
The 28 Edward I. one shilling contained	264
18 Edward III. - - - - -	236
27 Edward III. - - - - -	213
9 Henry V. - - - - -	176
1 Henry VI. - - - - -	142
4 Henry VI. - - - - -	176
49 Henry VI. - - - - -	142
1 Henry VIII. - - - - -	118
34 Henry VIII. - - - - -	100
36 Henry VIII. - - - - -	60
37 Henry VIII. - - - - -	40
3 Edward VI. - - - - -	40
5 Edward VI. - - - - -	20
6 Edward VI. - - - - -	88
2 Elizabeth - - - - -	89
43 Elizabeth - - - - -	86

at which it continued to the present reign.

The following account of the exports and imports in the 28th of Edward III., said to be found in a record of the exchequer, was published by Edward Miffeldon, merchant, in the year 1623.

Exports.	£	s.	d.
Thirty-one thousand six hundred and fifty-one sacks and a half of wool, at six pounds value each sack, amount to	189,909	0	0
Three thousand thirty-six hundred and sixty-five felts at 40s. value, each hundred at six score, amount to	6,073	1	8
Whereof the custom amounts to	81,624	1	1
Fourteen last, seventeen dicker, and five hides of leather, after six pounds value the last, amount to	89	5	0
Whereof the custom amounts to	6	17	6
Carried forward	277,702	5	3

	£	s.	d.
Brought forward	277,702	5	3
Four thousand seven hundred and seventy-four cloths and a half, after 40s. value the cloth, is	9,549	0	0
Eight thousand and sixty-one pieces and a half of worsted, after 16s. 8d. value the piece, is	6,717	18	4
Whereof the custom amounts to	215	13	7
Summary of the out-carried commodities in value and custom	294,184	17	2

Imports.

One thousand eight hundred and thirty-two cloths, after six pounds value the cloth	10,922	0	0
Whereof the custom amounts to	91	12	0
Three hundred and ninety-seven quintals and three quarters of wax, after the value of 40s. the hundred or quintal	795	10	0
Whereof the custom is	19	17	0
One thousand eight hundred and twenty-nine tons and a half of wine, after 40s. per ton	3,659	0	0
Whereof the custom is	182	0	0
Linen cloth, mercury, and grocery-wares, and all other manner of merchandize	23,014	16	0
Whereof the custom is	285	18	3

Summary of the in-brought commodities, in value and custom, is	38,970	13	3
Summary of the impulfage of the out-carried above the in-brought commodities, amounteth to	255,214	3	11

Admitting the correctness of this statement, which we have no reason to doubt, we must observe, that the cloth imported was of a higher value per yard than the cloth exported. Hence it may be inferred, that for several years after the arrival of the Flemish weavers, we were partly dependent on foreigners for our fine cloths; the coarser kinds then, as at the present day, forming the larger quantity of our exports. It is obvious also, that worsted goods had become an article of manufacture, nearly equal in importance with the woollen; and hence it is not improbable, that the greater part of the Flemish manufacturers were makers of stuffs and worsted goods, which was probably an entirely new trade in England.

The statutes in the following reigns, relating to the woollen manufacture, prove the narrow and selfish policy by which the manufacturers were influenced: these statutes refer either to restrictions which they wanted to impose, in order to confine the trade to themselves, or are made to prevent them from fraudulently packing or weaving their goods. In consequence of these fraudulent practices, the 13th statute of Richard II. makes the following regulations, which are curious, as marking the spirit of the manufacturers, and also as proving the early establishment of the woollen trade in the western counties, where it now flourishes. It runs thus: "Forasmuch as divers plain cloths, wrought in the counties of Somersset, Dorset, Bristol, and Gloucester, be tacked and folded together for sale; of which cloths a greater part be broken, bruised, and not agreeing in the colour, neither according to the breadth, nor in no manner to the part of the same cloths shewed outwards, but falsely wrought with divers wools, to the great loss and damage

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damage of the people, inasmuch that the merchants that buy the same, and carry them out of the realm to sell to strangers, be many times in danger to be slain, and sometimes imprisoned and put to fine and ransom. Therefore it is ordained, that no plain cloth tacked and folded shall be set to sale within the same counties." The same act permits certain cloths of coarse wool to be made of the breadth of three quarters, and appoints one weight and measure through the kingdom, except in the county of Lancaſter. Another ſtatute, in the ſame reign, allows every perſon to make cloth of what length and breadth he will, provided the aulnage and other duties are paid, and it be meaſured and ſealed by the king's aulnager, and contain no deceit. The kinds of worſted goods which might or might not be exported, were alſo ſpecified in this ſtatute. During this reign it appears, notwithstanding the increaſe of our trade, that we annually exported about one hundred and thirty thouſand packs of wool, paying a duty of one hundred and ſixty thouſand pounds.

In the 4th of Henry IV. the cloths made in London and the ſuburbs were ordered to have a ſeal of lead attached, and in a ſubſequent ſtatute no cloths were to be folded before the aulnager had ſet his ſeal to them. In the following reign, the narrow cloths, called the dozens of Devonſhire and Cornwall, are ordered to pay cocket cuſtoms, after the rate of broad-cloths.

In the reign of Henry VI. the exportation of woollen yarn is prohibited, and this prohibition ſeems to have been in full force when wool was allowed to be freely exported. The only reaſon aſſigned for this is, that the yarn paid no duty. During this reign two cloth-ſearchers were appointed for every hundred throughout the realm, who were to inſpect and ſeal all cloth, taking one penny for each. This proves that the manufacture of woollens had ſpread over a great part of the kingdom. It is probable that this inſpection extended to all cloths made in private families, which were ſent to the fulling-mills.

The worſted trade was alſo increaſing rapidly at this time: four wardens of worſted-weavers were appointed for the city of Norwich and two for the county of Norfolk, who were to make due ſearch of worſteds, and of what length and breadth they were made. In the ſame reign it was ordained, that "if our woollens were not received in Brabant, Holland, and Zealand, then the merchandize growing or wrought within the dominions of the duke of Burgoine ſhall be prohibited in England, under pain of forfeiture." Hence we learn, that we very ſoon began to ſupply theſe ſame countries with woollens and worſteds, from which we had received workmen a century before.

In the third year of Edward IV. the woollen trade had increaſed ſo much, that the importation of woollen cloth, caps, &c. was prohibited. Woollen caps or bonnets were then univerſally worn; they were either knitted or made of cloth, and a large quantity of wool muſt have been conſumed in their fabrication. About the year 1482, hats made from felts were introduced; but the manufacturers of caps, called the cappers, continued a powerful body a century afterwards. In the ſame reign, the wardens of worſteds at Norwich were doubled, or increaſed to eight.

The manufacture of fine broad-cloth muſt have been conſiderably improved about this time; for in the fourth of Henry VII. it was thought prudent to fix a maximum on the price of fine cloth, by which every retailer of cloth who ſhould ſell a yard of the fineſt ſcarlet grained cloth above ſixteen ſhillings, or a yard of any other coloured cloth above eleven ſhillings, was to forfeit forty ſhillings per yard for the ſame.

In the year 1493, in conſequence of a quarrel between Henry VII. and the archduke Philip, all intercourſe between the Engliſh and Flemiſh ceaſed, and the mart for Engliſh goods was transferred from Antwerp to Calais. This interruption to the regular courſe of trade was ſeverely felt by the woollen manufacturers. Lord Bacon, mentioning the renewal of the trade with Flanders, which took place again in 1496, ſays, "By this time the interruption of trade between the Engliſh and Flemiſh began to pinch the merchants of both nations very fore. The king, who loved wealth, though very ſenſible of this, kept his dignity ſo far as firſt to be fought unto. Wherein the merchant adventurers likewiſe did hold out bravely; taking off the commodities of the kingdom, though they lay dead upon their hands for want of vent." The merchant adventurers he deſcribes as "being a ſtrong company, and underſet with rich men." It is not, however, very probable, that this company would continue to purchaſe goods without a proſpect of gain. Theſe merchant adventurers were divided into two bodies; thoſe of London, which were the moſt powerful; and the merchant adventurers of England, who paid a fine to the former on all goods ſold at the foreign marts.

In the reign of Henry VIII. the woollen trade, and particularly all kinds of worſted manufactures, appear to have been in a very flouriſhing ſtate, though trade ſuffered ſeveral ſevere checks from the wars in which we were engaged. In the year 1527, Henry having entered into a league with France againſt the emperor Charles V., all trade with Spain and the Low Countries ceaſed. The goods ſent to Blackwell-hall found no purchaſers, the merchants having their warehouſes filled with cloths; the poor manufacturers being thus deprived of employment, an inſurrection took place in the county of Suffolk, where four thouſand of them aſſembled, but were appeaſed by the duke of Norfolk. The merchants were ſummoned to appear before cardinal Wolſey, who in the name of the king reprimanded them in an angry tone for not purchaſing the goods brought to market, and threatened them that his majeſty would open a new mart at Whitehall, and buy of the clothiers to ſell again to foreign merchants; to which menace one of them pertinently replied, "My lord, the king may buy them as well at Blackwell-hall, if it pleaſes him, and the ſtrangers will gladdier receive them there than at Weſtmiſter."—"You ſhall not order that matter," ſaid the cardinal; "and I ſhall ſend into London to know what cloths you have on your hands, and by that done, the king and his council ſhall appoint who ſhall buy the cloths, I warrant you." With this anſwer the Londoners departed. Grafton's Chronicle, vol. ii. p. 1167-8.

The interference of the cardinal raiſed the ſpirits of the manufacturers for a time, but originating in ignorance of the nature of trade, it could only have a temporary effect, and goods ſell again till a truce between England and Flanders was made for the benefit of trade. This fact ſhews the dependance of England, even at that time, on the export of manufactured woollens. In this reign we find Lancaſhire and Cheſhire firſt named as ſeats of the manufacture of coarse woollens; they are mentioned, together with Cornwall and Wales, as diſtricts where friezes were made. It appears from various references, that Norfolk and Suffolk were then flouriſhing ſeats of the worſted manufacture, and of all goods made with a worſted warp. Wardens were allowed to the towns of Yarmouth and Lynn, but with a ſelfiſh reſtriction, that the pieces were to be dyed, ſpun, or callendered in the city of Norwich. In the laſt year of this reign, an act was paſſed to prevent any

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persons besides woollen manufacturers, who bought wool for their own use, and merchants of the staple, who bought for exportation, to purchase wool with the intent to sell again. This act extended to twenty-eight counties, and secured a monopoly of the wool to the merchants of the staple, and to the rich clothiers. In the first year of the following reign, Edward VI., it was repealed, so far as to allow every person dwelling in Norwich and Norfolk, to buy wool the growth of that county, by themselves or agents, and retail it out in open market. The reason assigned is this: That almost the whole number of poor inhabitants of the county of Norfolk and city of Norwich had been used to get their living by spinning of Norfolk wool, which they used to purchase by eight pennyworth or twelve pennyworth at a time, selling the same again in yarn; and because the grower chose not to parcel it in such small quantities, therefore for the benefit of the poor, the wool of Norfolk was allowed to be purchased by wool-dealers. By this act, the 33d of Henry VIII., for prohibiting the exportation of yarn is made perpetual. The manufacture of woollens in the counties adjoining London appear to have been extensive, particularly in the county of Berkshire; for in the beginning of the reign of Henry VIII., John Winchcombe, of that county, commonly called Jack of Newbury, was celebrated as the greatest clothier in England. He kept one hundred looms in his own house, and in the expedition against the Scotch, he sent to Floddenfield one hundred men, fully equipped, at his own expence. Even so early as the 13th century, one Thomas Cole was distinguished by the name of the rich clothier of Reading, in Berkshire.

York, then the second city in the kingdom, and from its connection with the port of Hull well situated for the export trade, was probably an early seat of the woollen manufacture. We have already mentioned the settlement of two clothiers from Brabant in the time of Edward III. We do not learn precisely in our early historians, when the manufactures emanated from that city into the western parts of the county; but from an act in the 34th of Henry VIII. we are informed, that the chief manufacture of that city was the making of coverlets; the act recites, "that the poor of that city were daily employed in spinning, carding, dyeing, weaving, &c. for the making of coverlets, and that the same have not been made elsewhere in the said county till of late; that this manufacture had spread itself into other parts of the county, and was thereby debased and discredited, and therefore it is enacted, that none shall make coverlets in Yorkshire but the people of York." Thus we see, under the flimsy pretext of public benefit, the manufacturers were willing to disguise that selfish spirit of monopoly, which disgraces almost every page of our commercial history. The municipal regulations of the city of York, which were, and still continue to be, hostile to a free trade, probably obliged many manufacturers, who were not sharers in the monopolies of the guild, to establish themselves in the western villages of the county, where provisions were cheaper, and where they could carry on their trade without restriction. In the reign of Philip and Mary, soon after this period, we have the following interesting account of Halifax, in consequence of an act passed in the 37th of Henry VIII. to prevent any other persons than merchants of the staple and woollen manufacturers from buying wool in the county of Kent and twenty-seven shires. The poorer manufacturers, who were unable to lay in their stock of wool at one time, being hereby deprived of their trade, made application for redress, which was granted. The act recites as follows: "Whereas the town of Halifax being

planted in the great waste and moors, where the fertility of the ground is not apt to bring forth any corn nor good grais, but in rare places, and by exceeding and great industry of the inhabitants; and the same inhabitants altogether do live by cloth-making, and the greater part of them neither getteth corn, nor is able to keep a horse to carry wools, nor yet to buy much wool at once, but hath ever used to repair to the town of Halifax, and there to buy some two or three stone, according to their ability, and to carry the same to their houses, three, four, or five miles off, upon their heads and backs, and so to make and convert the same either into yarn or cloth, and to sell the same, and so to buy more wool of the wool-driver; by means of which industry, the barren grounds in those parts be now much inhabited, and above five hundred households there newly increased within these forty years past, which now are like to be undone and driven to beggary by reason of the late statute (37th of Henry VIII.) that taketh away the wool-driver, so that they cannot now have their wool by such small portions as they were wont to have, and that also they are not able to keep any horses whereupon to ride or fetch their wools further from them in other places, unless some remedy may be provided. It was therefore enacted, that it should be lawful, to any person or persons inhabiting within the parish of Halifax, to buy any wool or wools at such time, as the clothiers may buy the same, otherwise than by engrossing and forestalling, so that the persons buying the same do carry the said wools to the town of Halifax, and there to sell the same to such poor folks of that and other parishes adjoining, as shall work the same in cloth of yarn, to their knowledge, and not to the rich and wealthy clothier, or any other to sell again. Offending against this act to forfeit double the value of the wool so sold."

From this we learn that many woollen manufacturers had been either driven from York at an early period, by the oppression of the municipal regulations, or had retired where provisions were cheaper, and where they had better streams for the erection of fulling-mills, and for other processes of the manufacture, such as dyeing and scouring.

The woollen manufactures also gradually retired from the vicinity of the metropolis, owing to the increased price of provisions and labour, and probably also to the difficulty of obtaining commodious streams for the scouring and fulling of cloth, when the country round London became more populous. In the latter part of the reign of Henry VIII. we are informed, that the king demised to William Webbe the subsidy and aulnage of all cloth made in the county of Monmouth, and in the twelve shires of Wales. A former act of this reign, speaking of the manufacturers of North Wales, says, they had been used to sell their cloths so craftly and hard rolled together, that the buyer could not perceive the untrue making thereof. These acts prove the extension of the woollen manufactures westward.

In the same reign, an act mentions the woollen manufactures as being established in Worcester-shire, but prohibits any one from making cloth in the county, except within the city of Worcester, and in the towns of Evesham, Droitwich, Kidderminster, and Bromsgrove; and forbids the owners of houses in those places from letting them at advanced prices to the cloth-manufacturers. The woollen manufacture has continued to the present day at the two last of these towns. In the reign of Edward VI. Coventry and Manchester are mentioned as manufacturing places. The manufacturers in the old established seats of the woollen trade appear to have been greatly alarmed at the extension of the cloth manufacture, and to have exerted all their influence to refrain it. Near the conclusion of the reign of

Philip

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Philip and Mary, an act in 53 sections was passed, relating to the making of woollen cloths. It enacts, that no person shall make woollen cloth but only in a market-town, where cloth hath commonly been used to be made for the space of ten years last past, or in a city, borough, or town corporate. From this restricting act, however, the following exceptions are made: to all persons who dwell in North Wales or South Wales, Cheshire, Lancashire, Westmoreland, Cumberland, Northumberland, the bishopric of Durham, Cornwall, Suffolk, Kent, the town of Godalmin in Surrey, or in Yorkshire, being not within twelve miles of the city of York, or any towns or villages near the river Stroud in Gloucestershire. This act, so absurd and oppressive, was obliged to be modified in the first year of the following reign, by an act entitled "An Act for the continuing and making of Woollen Cloths in divers Towns in the County of Essex." Bocking, Watherfold, Cockshill, and Dodham, are the towns specified.

In consequence of the increase of our manufactures, the export of wool had nearly ceased before the reign of Elizabeth; and a considerable advance appears to have taken place in the price of food, clothing, and rents. The export trade of England was carried on very extensively by three companies of merchants, the merchants of the Stillyard, who were foreigners, the merchants of the Staple, and the merchant adventurers, who were English. See **STILLYARD, STAPLE, and ADVENTURERS.**

The merchants of the Stillyard were of ancient standing, and were originally from the Hanse towns: they had great privileges granted them, and particularly they were allowed to export and import all wares and merchandize, on payment of the small duty of one and a quarter *per cent.* This gave them a decided advantage over the other companies; and it is alleged that they lent their name to cover the import and export of goods belonging to private merchants, and thereby evaded the regular duties on such goods. This company had engrossed a considerable part of the cloth trade. In the year 1551 they exported 44,000 cloths; soon after which this company was dissolved. The merchant adventurers succeeded to that branch of their trade: according to the account of John Wheeler, secretary to the company, there were annually shipped by them 60,000 white cloths, worth 600,000*l.*, and 40,000 cloths of all sorts, baizes and kerseys, worth 400,000*l.*, besides wool and woollens. We are told by Camden, that, in this reign, the commerce between England and the Netherlands rose to above twelve millions yearly, and the woollen trade alone amounted to five millions. The Latin terms which Camden employs, *milliones aureorum*, leaves the amount intended uncertain: if we suppose it to be ducats, the quantity is much greater than England exported at that time; probably florins were intended, which makes the amount about 750,000*l.*

Besides the exports to Antwerp, English cloth was at this time sent to Amsterdam, Hamburgh, Sweden, Russia, and other countries. The woollen trade of England had now advanced to a higher state of prosperity than at any former period; and from this time it appears to have declined until after the revolution of 1668. In this reign, the price of wool, which we believe to mean long or combing wool, had advanced from 13*s.* 4*d.* to 22*s.* *per* tod; and the shilling containing the same weight of silver as our late coinage, *viz.* 86 grains, the relative value of a tod of long wool was considerably more than it has ever been during the present reign.

The declension of our manufactures in the succeeding reigns of the Stuarts, as we have reason to believe, extended much more to woollen cloths than to worsted pieces. Long

wool, or combing-wool, was more the peculiar produce of England than clothing-wools. The latter were grown in abundance, and of a superior quality, in Spain, Portugal, and France; but the combing-wools of England, on account of the superior soundness of the staple or fibre, and the quantity supplied, gave a decided advantage to our manufacturers of stuffs or worsted pieces.

The persecution of the Protestants by the duke of Alva in the Netherlands drove multitudes of the manufacturers into England, where they were graciously received by Elizabeth, who gave them liberty to settle at Norwich, Colchester, Sandwich, Maidstone, and Southampton. These refugees contributed to extend our manufactures of worsted goods and light woollens, called bays and says; they also introduced the manufacture of linens and silks, and it is supposed that they first taught the art of weaving on the stocking-frame.

In the latter part of the reign of Elizabeth an act was passed to relieve the counties of Somerset, Gloucester, and Wiltshire, from those absurd and oppressive statutes which confined the making of cloth to corporate towns. This act, which gave to all persons residing in these counties the privileges of free trade, could not fail to extend and establish the woollen manufactures in these parts, and they have remained to the present time the principal seats of the superfine cloth trade, whilst many manufacturing corporate towns, which were then flourishing, have sunk to decay. Various acts, regulating the length, breadth, and tentering of woollen goods of different kinds, were also passed in this reign, referring to the counties of Oxfordshire, Devon, and the counties north of Trent, particularly Yorkshire and Lancashire. The importation of foreign wool-cards was also prohibited. The act recites, that many thousands of woollen card-makers and card-wire drawers, living in London, Bristol, Gloucester, Norwich, Coventry, and elsewhere, had heretofore subsisted themselves and families upon that business, which was now greatly impaired by the importation of wool-cards. No laws prohibiting the export of wool were thought necessary in this period of our history, and it continued to be exported during the whole of this reign, as appears by the account of the merchant adventurers, who exported it together with cloth; but though wool was freely exported, an act was passed to prevent the carrying of live sheep, lambs, or rams out of England; but the reasons for this act are not recited, though it states it was for divers good causes and considerations. The internal tranquillity that the country enjoyed during this long reign, the influx of foreign makers of new kinds of worsteds, and other articles not known before, the opening of a new trade to Turkey and the Barbary states, by treaty in the year 1579 and in 1585, all greatly contributed to the extension of the woollen trade and manufactures. There were indeed other circumstances which must have operated against our manufacturers in part of this reign. The interruption of commerce between England and the Netherlands in 1564, which lasted some time, the wars with Spain, the sacking of Antwerp, in which the English merchants suffered severely, gave a considerable check to the foreign trade; yet we have seen that the merchant adventurers alone exported woollens to the amount of one million sterling towards the latter end of this reign. The demand at home for woollens must also have greatly increased during the long period of domestic tranquillity which the nation at that time enjoyed, and particularly from the prevailing taste for costly dresses which has spread from the court through the country.

A great part of our woollen exports hitherto consisted of white undressed cloth; but in the following reign of James I. it was represented as bad policy to permit the exportation of cloth in this state, and thereby lose the profit on the

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dyeing and finishing. A letter exists addressed to king James on this subject, ascribed to sir Walter Raleigh, but without sufficient evidence, as "the most ancient manuscripts of this letter in the libraries of the nobility ascribe it to John Keymer." (Oldy's Life of Sir W. Raleigh.) In this letter it is stated, "that there have been eighty thousand undressed and undyed cloths exported yearly, by which the kingdom has been deprived of four hundred thousand pounds for the last fifty-five years, which is nearly twenty millions that would have been gained by the labour of the workmen in that time, with the merchants' gains for bringing in dyeing-wares, and return of cloths dressed and dyed, with other benefits to the realm." The writer proceeds, in another part, to state, that there had also been exported in that time annually, of baizes and northern and Devonshire kerfies, in the white, fifty thousand cloths, counting three kerfies to a cloth, whereby had been lost about five millions to the nation in labour, profit, &c. The author informs us, that the baizes so exported were dressed and dyed at Amsterdam, and shipped to Spain, Portugal, and other kingdoms, under the name of Flemish baize, setting their own seal upon them; "so that we lose the very name of our home-bred commodities, and other countries get the reputation and profit thereof." The author concludes with asserting, that the nation loses a million a year by the export of white cloths, which might be dressed and dyed as well at home. This letter has been often quoted as containing unanswerable reasons for confining the whole process of the cloth manufacture to our own country; but, like other monopolists, the writer seems to forget that there are two parties in all mercantile transactions, and that manufactured goods must be sent in that state in which the purchaser is willing to receive them, unless it be proved that he cannot procure them elsewhere. Let us mark the result. Alderman Cockayne, and other London merchants, had sufficient influence with the government to obtain the prohibition of the export of white cloths, and to secure a patent for dressing and dyeing of cloths. In consequence of which, the Dutch and Germans immediately prohibited the importation of dyed cloths from England, which gave so great a check to our export trade, that in the year 1616, the whole amount of cloths exported of every kind amounted only to sixty thousand, so that the export trade in woollens had fallen to less than one-third of its former amount; and in the year 1622,

	<i>l.</i>	<i>s.</i>	<i>d.</i>
All our exports of every kind } amounted only to -	2,320,436	12	10
Whilst our imports were -	2,619,315	0	0
Leaving a balance against us of	298,878	7	2

It being from experience proved, that the policy of dressing and dyeing all our goods at home had produced the greatest injury to the woollen trade, the restrictions were taken off, and the export for white cloth left free. In the former reign, cloths about four pounds value were, by statute, to be sent out dyed, by all persons except the company of merchant adventurers, who obtained a licence to export all sorts of white cloths; and though this was itself a monopoly, yet, as it gave foreigners an opportunity of receiving our finer cloths in the state which they most wanted, it was the means of increasing our trade: indeed it is said by Misselden, that "within a few years after granting this licence, the vent for cloth in foreign parts increased to twice as much as it had been during the strict observance of the statute." With this fact before their eyes, it is scarcely possible that our statesmen at that time could have proceeded to the pro-

hibition of white cloth exports, unless they had been (as was asserted) influenced by presents from alderman Cockayne and the rich merchants, who expected to receive the benefit arising from the prohibition, and the exclusive right of dyeing and dressing. The wool-growers equally felt the ill effects of this prohibition. Wool is said to have fallen from thirty-three shillings *per* tod to twenty shillings; if by this is meant the long combing-wools, the former price, considering the value of money at that time, is much higher than it has been in the last or the present century.

During the reigns of the Stuarts, the infamous policy they adopted struck not only at the liberty, but at the commercial prosperity of the country. Archbishop Laud, imbued with the malignant zeal of a bigot, commenced his attacks on the descendants of the French Protestants, established as manufacturers of woollens in Norfolk and Suffolk, from which counties his persecuting fury drove some thousand families. Many of them settled in New England; but others went into Holland, where they were encouraged by the Dutch, who allowed them an exemption from taxes and rents for seven years. In return for this, the states were amply repaid by the introduction of manufacturers, with which they were before unacquainted. In the year 1622, king James issued a proclamation to prohibit the exportation of wool, fuller's-earth, &c. In 1640 wool was again admitted to be exported on the payment of certain duties; and we are told, that in the same year sir John Brownlowe, of Belton in Lincolnshire, sold three years' wool at twenty-four shillings *per* tod to a baize-maker of Colchester. As it is reasonable to suppose that this was the long combing-wool of that county, it shews the high relative price of the article at that time. In 1647, owing to the high price of wool, its exportation was again prohibited.

During the civil wars, the manufactures and export trade of England declined, and the Dutch availed themselves of this to extend their own manufacture and export of woollens, particularly to Spain, from whence they brought fine Spanish wool. At this time it appears, that the woollen manufactures in Poland and Silesia were rapidly increasing; and the English government received information that two hundred and twenty thousand cloths were made there annually, besides considerable quantities made at Dantzic, and in the vicinity.

The duke of Brandenburg, it was also stated to our government, had ordered one hundred thousand ells of Silesia cloth at Königsberg for his troops, which had been heretofore supplied with English cloth. The estimation in which our cloth had been held is said to have been lost by negligence in the manufacture, particularly in the spinning and weaving. The Dutch and Poles had a little before this time received a great number of Protestant manufacturers, who fled from the persecution of the duke of Alva in Brabant and Flanders.

Here it may be proper to remark, that the English as a nation had little intercourse with other parts of the world, except through a few large trading companies: hence they were extremely ignorant respecting the state of foreign countries, and supposed that the cloth trade had been confined to their own country for three hundred years; and they considered the establishment of other manufacturers as a novelty and infringement of their just rights. With these views, it was proposed to obtain a complete monopoly of all the clothing-wools in Spain, in order to prevent the Dutch and other nations from rivalling our manufactures. This is the more extraordinary, as the English had not then learned, like the Dutch, to manufacture Spanish wool, without mixing it with that of their own country. It is needless to say, that

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the negociation of fir William Godolphin for this selfish monopoly of wool was not successful. During the whole reign of Elizabeth, when our woollen manufactures were in the highest state of prosperity, wool and woofels were permitted to be exported. In the reign of James I. and Charles I., when the trade was declining, proclamations were issued to prevent the exportation of wool, and also that of fuller's-earth. During the commonwealth, an ordinance of parliament was issued to prohibit the exportation of wool and fuller's-earth, on pain of forfeiture of the wool, and a penalty of 3*s.* *per* pound on every pound of fuller's-earth. The first act of parliament which absolutely prohibited the exportation of wool by making it felony, and which could not be set aside by a royal licence, is the 12th of Charles II., which was passed soon after the Restoration.

The grounds of this measure are stated in the preamble of the act: "For the better preventing the losses and inconveniences which have happened by and through the secret and subtle exportation of wool out of the kingdom; and for the better setting to work the poor people and inhabitants of the kingdom, to the intent that the full and best use and benefit of the principal native commodities of the kingdom may redound to and be unto and amongst the subjects and inhabitants of the kingdom, and not unto any foreign states." Previous to this time, the proclamations and ordinances issued to prevent the exportation of wool, for the most part, signified nothing more than the imposition of a duty or a composition for exporting by licence from the government, what on other terms was forbidden, under penalties of confiscation, fine, or imprisonment. We have seen that, from the death of Elizabeth to the Revolution in 1688, the woollen trade was generally in a languishing state. In the year 1665, Thomas Telham of Warwickshire; with two thousand manufacturers, left the kingdom, and established themselves in the Palatinate, and commenced a woollen manufacture there, and were greatly encouraged by the elector. The establishment was soon afterwards joined by a number of manufacturers from Hertfordshire.

During the period from Elizabeth to the year 1668, the English appear to have made no improvement whatever in their modes of manufacture of woollen cloth, whilst the neighbouring nations had been making a gradual progression, both in the style of their manufacture, and the amount annually produced. It was especially in the manufacture of fine cloths that their superiority was manifest. The Dutch, in particular, were far more expert than the English in the dressing and dyeing of cloth. This will appear from the following remarkable fact stated by Coke, vol. ii. p. 169. In the year 1668, one Brewer, with about fifty Walloons, who wrought and dyed fine woollen cloths, came into England, and received the royal protection and encouragement. By him the English were first instructed how to manufacture cloth of the best Spanish wool, without any admixture with inferior wool; and also to manufacture and dye fine cloths cheaper by 40 *per cent.* than they had done before. Ten years before this time, it had been published and admitted in England, that "Spanish wool alone could not be wrought into cloth." It may seem truly extraordinary that the English, who had so long carried on the manufacture of woollen cloth, had not availed themselves of the revolution in Flanders, which drove away the best master manufacturers, to encourage their settlement in this country. M. Huet explains the fact in a way which is not very creditable to the liberality of the English manufacturers, or to the wisdom of our institutions. "It was owing to the municipal laws of England, and its usages towards strangers; who, besides being doubly rated at the custom-house, were excluded from all companies or fraternities of trade; and were

not allowed to carry on manufactures as masters or partners; unless such as the natives were unacquainted with; so that none of the Flemish master manufacturers of fine cloth went thither (to England), their's being a mystery not accounted new, though very much superior to the cloth working then known in England. It was only those who wrought in new kinds of worsteds, serges, damasks, or stockings, who went thither. The same policy was also adopted by the Hanse towns: hence the greater part of the vast and profitable trade, which was lost to Antwerp, centered necessarily in Holland, where the manufacturers from Brabant were cordially received." This appears a satisfactory explanation why the English, in 1668, were so much inferior to the Dutch in the manufacture of fine cloth.

In the year 1660, however, our manufacturers began to be aware of the superiority of Spanish wool, and to mix it with the best English, probably in what were called medleys or mixture-cloths, or else employing the English wool for warp, and covering it with west of Spanish wool. The best Spanish wool was then 4*s.* and the second sort 3*s.* *per* pound, and the best English 1*s.* 6*d.* *per* pound.

It is deserving of notice, that, in the latter period of the Commonwealth, our trade is said to have greatly revived, but to have suffered a miserable depression almost immediately after the restoration of Charles II. In a letter of M. Downing of the Hague to the president of the council in London, 1660, printed in Thurloe's State Papers, vol. vii. p. 848. it is stated, that great quantities of wool were brought secretly from England to Holland; and he adds, that the Dutch had at that time got in a great measure the manufacture of fine cloth, and would probably, with Silesia, engross also the manufacture of coarse cloth, and leave England nothing but its native wool to export.

In the year 1662, great complaints were made against the merchant adventurers for their neglect of the cloth trade; in reply to which they said, that the demand for English cloths failed in the foreign markets, the white clothing trade having abated from 100,000 cloths annually to 11,000. In the year 1663 our whole exports were only about two millions, and our imports four, leaving a balance of two millions against this country. It is, however, deserving notice, that the number of wardens for the inspection of stuffs at Norwich being too few, they were at this time increased from five to eight. A letter on the state of trade, published in 1667, says, clothing-wools were so much fallen at that time, that the best Spanish was sold at 2*s.* 2*d.* *per* pound, and English at 8*d.* *per* pound. The writer ascribes the fall in the price of English wool to our wearing so much Spanish cloth, a great part not manufactured by ourselves, as Dutch blacks; but it is obvious, from the price of Spanish wool, that the low price of clothing-wools at that time depended on a more general cause, affecting all manufacturing countries. To relieve the cloth trade from the great depression under which it laboured between the years 1660 and 1678, various schemes were devised. Among others, the mayor and common council of London passed an act "for the regulation of Blackwell-hall, Leaden-hall, and Welsh-hall, (the three public markets for cloth in London,) and for preventing foreigners buying and selling!" By foreigners are understood all persons not free of the city of London. This act, a most singular monument of the ignorance or selfishness of its authors, prohibits the sale of all woollen cloths sent to London, except at the above halls, where certain duties were to be paid upon them, and from whence they could not be removed for three weeks, unless they were sold in the meantime to some draper, or other freeman of the city. The hall-keepers were to attend strictly at the halls, and

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turn out all foreigners and aliens coming to purchase cloth; and every freeman of the city who should introduce a purchaser into the halls not free of the city should forfeit, for the first offence, five pounds,—for the second, ten,—and for the third, fifteen pounds! Thus, in those days, turning purchasers out of the public markets, and securing the sale to a certain class of buyers, was considered an act for the benefit of the public.

The Irish had, a little before this time, commenced the manufacture of woollens and worsteds, which appears greatly to have alarmed the English manufacturers. The wools of Ireland had increased in quantity, in consequence of a tyrannical act passed a little before this period, to prevent the Irish from sending cattle to England, which obliged them to convert their grounds into sheep-pastures. They were, however, prohibited from exporting their wool to foreigners, it being made felony; and the exportation to England, in any other than a raw state, exposed it to confiscation. About the year 1640 some clothiers from the west of England established a woollen manufacture at Dublin, where it flourished a considerable time. About the same period, sixty families of manufacturers from Holland settled at Limerick: these were ruined by the wars which ensued. Other English clothiers settled at Cork and Kinfale; a few French manufacturers of druggets settled at Waterford; and a more considerable establishment of the cloth manufacture was formed at Clonmel, supported by the capital of some London merchants, who had agents there. These establishments, though obviously inadequate to the supply of one-fourth part of the population of Ireland, excited great jealousy in the English manufacturers; and during the great depression of the woollen trade between the years 1660 and 1668, a part of this distress was ascribed to the rivalry of the Irish clothiers. The English farmers, at the same time, ascribed the low price of wools to the great importations of wools from Ireland; and the merchants ascribed the failure of the foreign demand for cloth to the clandestine exportation of English and Irish wools.

Sir William Petty, in the year 1672, estimates the sheep in Ireland at four millions, and the weight of each fleece at two pounds. The latter, however, is obviously not more than half the true average weight of the fleece, and the number is supposed by some to be below what it was a few years afterwards. If the number of sheep be correct, and taking the fleece of each at four pounds, this would make the total amount of Irish wools only 66,000 packs, of which three-fourths were consumed in Ireland.

The alarm and jealousy excited in England by the Irish woollen manufactures produced measures that almost compelled the Irish to export their wools clandestinely to the continent. An act was passed in the year 1699 prohibiting the exportation of woollen manufactures from Ireland, except to a few parts in England and Wales, where the duties imposed amounted to a total prohibition. Various addresses have been presented to the king and both houses of parliament, "beseeching his majesty to take effectual measures to prevent the growth of the woollen manufactures in Ireland." The Irish parliament was influenced to impose a duty in the same year of four shillings in the pound on their own manufactures when exported. These unjust proceedings were intended to annihilate the export trade for Irish woollens; and, in consequence, their wool and worsted yarn that was not consumed at home were sent to England, or to the continent clandestinely. The first four years after the destruction of their manufactures, these exports to England were as follow:

	Stone of Wool, 18lbs. per Stone.	Stone of Yarn, 18lbs.	Total of Wool and Yarn.
1700	336,292	26,617	362,909
1701	300,812	23,390	326,202
1702	315,473	43,648	359,121
1703	360,862	36,873	397,735

The average annual amount of wool and yarn, as above, may be stated at thirty thousand packs. But after this period the exports to England declined, owing no doubt to the clandestine exportation of wool to the continent, for which the numerous creeks and harbours offered such facility.

In 1711, and the three following years, the quantity exported to England was as under:

	Wool.	Yarn.	Total.
1711	310,136	52,273	365,409
1712	263,946	60,108	324,054
1713	171,871	68,548	240,409
1714	147,153	58,147	205,800

A few years after this, the decline was still more considerable in the amount of wool exported, but that of yarn continued to increase a little:

1726	51,371	87,261	138,632
1727	58,182	72,047	130,229
1728	49,784	80,428	130,212
1729	38,667	91,854	130,521

A further encouragement to clandestine importation was given by an impolitic duty of *2s. 4d. per stone* on wool sent to England, which, as the average price did not exceed *6s. 6d.*, was full thirty *per cent.* on the first cost. It will be seen subsequently, that the woollen manufactures of England were all this time progressively increasing, so that the decline in the imports of wool from Ireland were not occasioned by a declension of trade; the Irish had found other markets for their wool.

From a work entitled "A New Discourse of Trade," by sir Joshua Child, supposed to have been published about the year 1667, we learn several important particulars respecting the woollen trade. "Though our vent for fine cloths and stuffs to Turkey, Italy, Spain, and Portugal, were, he says, declined, yet we retained a considerable part, principally because the wool of which our middling coarse cloths are made is our own, and consequently cheaper to us than the Dutch can steal it from us." In another part he judiciously observes, that the acts for regulating manufactures, resolve themselves at last into a tax on the commodity, without respect to the goodness of it, as most notoriously appears in the business of aulnager, which doubtless our predecessors intended for a scrutiny into the goodness of the cloth; and to that purpose a seal was invented as a signal, that the commodity was made according to the statute; which seal, it is said, may now be bought by thousands, and put upon what the buyers please. Sir Joshua Child admits that wool was eminently the foundation of English riches, and that all possible means should be used to keep it within the realm; but the only efficacious measures to effect it are not penal statutes, but encouragement to trade. The impediments at that time he states to be, 1st, The high rate of interest; 2d, Want of hands, which an act of naturalization would cure; 3d, Compulsion (persecution) in matters of religion. For he adds, "while our neighbours the Dutch have money at lower interest and more hands, by reason of general liberty of conscience, with other free privileges, both to natives and foreigners, there is no question but they will be able to give a better price for our wool than we can afford ourselves, and they that can give the best price for a commodity shall never fail to have it by one means or another, notwithstanding the opposition

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opposition of any laws by sea or land; of such, force, subtilty, and violence, is the general course of trade."

The same enlightened writer appears to have been the first Englishman who saw the injustice, absurdity, and impolicy of the numerous restrictions by which the manufacturers were obliged to make cloths of certain weights and lengths, to keep only a certain quantity of looms, or to prohibit dyers, fullers, &c. from carrying on other branches of the trade. "It would be (he justly observed) for the advantage of the trade of England, to leave all men at liberty to make what cloth and stuffs they please, how they will, when and where they will, and of any lengths or fizes."

One of the principal causes of the decay of our woollen manufactures sir Joshua Child might not think it prudent to state. This was the encouragement given to the consumption of French cloths and woollens in England, together with the total prohibition of English goods imported into France, or the imposition of duties which amounted to a prohibition. The French, under the administration of Colbert, had been extending and improving every branch of the woollen manufacture, and were become our great rivals in foreign markets, as well as at home. In the year 1678, acts were passed, the 29th and 30th of Charles II., prohibiting the importation of French commodities for three years. From this time trade began gradually to revive, and would have greatly increased, had not political causes operated as a check to our prosperity.

The improvements introduced in the manufacture of fine cloths by Brewer in 1668, and the more extensive consumption of Spanish wool, enabled us to oppose, with some success, the rivalry of the French.

After the accession of William, our manufacturers, who were warmly attached to the cause of religious liberty, being the greater part Protestant dissenters, were animated to uncommon exertions in the restoration of their trade. This is evident from the state of our exports in the following year after the revolution in 1689, when they amounted to near seven millions, of which the woollens were nearly three millions. This is the largest amount till the year 1715. A short time after the revolution, about the close of the century, our writers on Political Arithmetic, Mr. King and Dr. Davenant, give the following estimate of our national wealth, including wool, &c.:

	£
The annual income of England, of which the } people subsist - - - - -	43,000,000
Yearly rent of land - - - - -	10,000,000
Value of wool yearly shorn - - - - -	2,000,000
Woollen manufacture of England - - - - -	8,000,000
Woollen manufactures exported - - - - -	2,000,000

From this period, the woollen trade of England kept progressively increasing, though subject to some fluctuations. In the following years the amount exported were as under:

	value of woollens exported	£
1718		2,673,696
1719		2,730,297
1720		3,059,049
1721		2,903,310
1722		3,384,842

About the year 1722, the plague at Marfeilles, by preventing the exportation of French woollens, increased the demand for English manufactures considerably. In the year 1737, the woollen exports amounted to 4,158,643*l.*; and it is remarkable, that at that period the price of wool was uncommonly low.

The yearly medium value of woollen exports, } from 1739 to 1748, or to the peace of Aix- la-Chapelle, was - - - - -	£ 3,327,057
Yearly medium of woollen exports, from 1749 to 1753, was - - - - -	4,189,195

From this time to the period of the American war in 1775, the woollen manufactures, and particularly the worsted, still continued to increase, with occasional checks. The quantity of long combing-wools grown in England had given to the manufacturers of worsted goods a decided advantage over those of France, though the ingenuity of the latter in the manufacture of les petites draperies, as the worsted goods are called, was greatly superior to what our own workmen had ever shewn. The demand for worsted goods at home, for tammies and stuffs, which were the general dress of females before the year 1775, was very great; besides which, we supplied with worsted goods many of the southern parts of Europe, and particularly Spain and Portugal, for the use of their South American colonies, and for the dresses of the clergy, monks, and nuns, which form no inconsiderable part of the population in those countries. About the year 1775, the introduction of Arkwright's inventions for spinning, carding, &c. into the cotton trade, produced a great change in the article of female dress in England, stuffs and tammies being supplanted by cotton goods, which were become extremely cheap. The failure of the foreign trade also greatly affected our manufacturers, both woollens and worsteds. The price of English wool at the latter end of the American war was lower than it had been in any period of our history, when money was of much higher relative value. A tod of 28lbs. of the best Lincolnshire wool for combing was not worth more than nine shillings, and the inferior kinds six shillings, or about three-pence and four-pence *per* pound. From the time of Elizabeth to the middle of the last century, scarcely any alteration or improvements had taken place in the processes of manufacture, either in woollen or worsted, beyond the variation of colours or patterns, to suit the fashion of the day. The ingenious mechanical inventions of Arkwright, applied to the spinning and carding of cotton, were soon after modified, and applied to the woollen and worsted trade, and produced an entire revolution in some of the seats of their manufacture. Before that period, the manufacture of heavy woollens and coarse worsted goods had been gradually concentrating into Yorkshire and Lancashire, where the cheapness of living, the active industry of the inhabitants, and, above all, the cheapness and abundance of coal, gave the manufacturers a decided advantage over those in the midland and western counties. The following table, shewing the amount of broad and narrow cloths made in the West Riding of Yorkshire, will prove the fact most decisively. It may be proper to remark, that eighty years since, about 1738, when our woollen exports exceeded four millions sterling, the total number of pieces of broad and narrow cloth made in Yorkshire was only fifty-six thousand nine hundred. At present our woollen exports are only about double what they then were; but the number of cloths manufactured in Yorkshire is not less than four hundred and ninety thousand pieces, or eight times more than the quantity made at the period above referred to. It must be remarked also, that this account does not include the cloth manufactured in Lancashire, and the borders of Cheshire adjoining Yorkshire, nor the blankets, ferges, baizes, flannels, cassimeres, toilinetts, carpets, rugs, worsted goods, or any other description of woollens or worsteds, except plain and narrow broad-cloths. The total amount of these different woollen articles exceed, we believe, in weight, if not in value, that of the woollen cloths.

WOOLLEN MANUFACTURE.

An Account of the Number of Broad Cloths, milled at the several Fulling Mills in the West Riding of the County of York, from the 24th of June, 1725, (the Commencement of the Act,) to the 12th of March, 1726, and thence annually, distinguishing each Year; and of the Narrow Cloths, from the 1st of August, 1737, (the Commencement of the Act) to the 20th of January, 1738, and thence annually, distinguishing each Year; likewise the Number of Yards in Length, made each Year, from Easter Sessions, 1768.

Years.	Broads.		Narrows.		Years.	Broads.		Narrows.	
	Pieces.	Yards.	Pieces.	Yards.		Pieces.	Yards.	Pieces.	Yards.
1726	26671				1772	112370	322391 $\frac{3}{4}$	95539	237751 $\frac{1}{2}$
1727	28990				1773	120245	363561 $\frac{1}{4}$	89874 $\frac{1}{2}$	2306235
1728	25223 $\frac{1}{2}$				1774	87201	2587364 $\frac{3}{4}$	88323	2133583
1729	29643				1775	95878	2841213	96794	2441007
1730	31579 $\frac{1}{2}$				1776	99733	2975389	99586	2488140 $\frac{1}{2}$
1731	35563				1777	107750	3153891	95786	2601583
1732	35548 $\frac{1}{2}$				1778	132506	3795990	101629	2746712
1733	34620				1779	110942	3427150	93143	2659659
1734	31123				1780	94625	2802671	87309	2571324
1735	31744 $\frac{1}{2}$				1781	102018	3099127	98721	2671397
1736	38899				1782	112470	4458405	96743	2598751
1737	42256				1783	131092	4563376	108641	3292002
1738	42404		14495		1784	138023	4094335	115500	3356648
1739	43086 $\frac{1}{2}$		58848		1785	157275	4844855	116036	3409278
1740	41441		58620		1786	158792	4934975	123025	3536889
1741	46364		61196		1787	155748	4850832	128740	4058157
1742	44954		62804		1788	139406	4244322	132143	4208303
1743	45178 $\frac{1}{2}$		63545		1789	154134	4716460	145495	4409573
1744	54627 $\frac{1}{2}$		63065		1790	172588	5151677	140407	4582122
1745	50453		63423		1791	187569	5815079	154373	4797594
1746	56637		68775		1792	214851	6760728	190468	5531698
1747	62480		68374		1793	190332	6054946	150666	4783722
1748	60765		68080		1794	190988	6067208	130403	4634258
1749	60705 $\frac{1}{2}$		68889		1795	250993	7759907	155087	5172511
1750	60447 $\frac{1}{2}$		78115		1796	246770	7830536	151594	5245704
1751	60964		74022		1797	229292	7235038	156709	5503648
1752	60724		72442		1798	224159	7134114	148566	5180313
1753	55358		71618		1799	272755	8806688	180168	6377277
1754	56070 $\frac{1}{2}$		72394		1800	285851	9263966	169262	6014420
1755	57125		76295		1801	264082	8699242	137231	4833534
1756	33590 $\frac{1}{2}$		79318		1802	265660	8686046	137016	5023754
1757	55777 $\frac{1}{2}$		77097		1803	266785	8942798	139575	5023996
1758	60396		66396		1804	298178	9987255	150010	5440179
1759	51877 $\frac{1}{2}$		65513		1805	300237	10079256	165847	6193317
1760	49362 $\frac{1}{2}$		69573		1806	290269	9561178	175334	6430101
1761	48944		75468		1807	262024	8422143	161816	5931253
1762	48621		72946		1808	279859	9050970	144624	5309007
1763	48038 $\frac{1}{4}$		72096		1809	311239	9826048	151911	5951762
1764	54916		79458		1810	273664	8671042	158252	6180811
1765	54660		77419		1811	269892	8535559	141809	5715534
1766	72575 $\frac{1}{2}$		78893		1812	316431	9949419	136863	5117209
1767	102428		78819		1813	369890	11702837	142863	5615755
1768	90036		74480		1814	338869	10656491	147474	6045472
1769	92522	2771667 $\frac{3}{4}$	87762	2144019	1815	330310	10394466	162355	6649859
1770	93075	2717105	85376	2255625	1816	325449	10135285	120901	5650669
1771	92782	2966224 $\frac{1}{2}$	89920	2235625	1817	351122	10974473	132607	5233616

WOOLLEN MANUFACTURE.

In the table that will be afterwards given, it will be seen that the quantity of yards of different woollen articles exported, which are not included with cloths, greatly exceeds that of broad and narrow cloths. Taking this as a standard, it would appear that the cloth returned at the fulling-mills in the West Riding of Yorkshire is not more than one-third of the total quantity of woollens and worsteds of every description made in the West Riding of Yorkshire, and the borders of Cheshire and Lancashire. Now to make the quantity of broad and narrow cloth given in the returns of the West Riding, would require about one hundred and ten thousand packs: we may therefore state the annual consumption of wool in these districts to be from two hundred and fifty to three hundred thousand packs of 240 pounds each; and we may further state the amount consumed in these districts to exceed that of all the other parts of England and Wales collectively by one-third, including hosiery and all other articles made of wool. This will make the total amount of wool manufactured in England to be nearly what we have before estimated, or five hundred thousand packs.

The number of persons immediately employed in the various branches of the woollen manufacture in England was stated, in the year 1800, to be 1,500,000, and that the trade directly and collaterally employed double the above number. This was asserted in the speech of Mr. Law, now lord Ellenborough, in the house of lords, as counsel for the petitioners against the export of wool to Ireland. But we apprehend that the statement greatly exceeds the actual number employed in this trade, including their families.

The amount of the population of the West Riding of Yorkshire is nearly ascertained, and perhaps two-thirds of the whole may be engaged in the woollen manufacture, including the families of the persons employed. If we state these to be 340,000, exclusive of the woollen manufacturers in Cheshire and Lancashire, we shall certainly not under-rate them. A large part of the West Riding being agricultural solely, and in the manufacturing districts cutlery, as at Sheffield, and cottons in the more western parts, employ no considerable portion of the people. If then we take 340,000 as the amount of persons, with their families, engaged in the woollen trade in the West Riding, exclusive of Lancashire and Cheshire, and if we suppose that they are one-third of the total number of persons employed in the same manufacture in England, it will make the whole rather exceed 1,000,000 of manufacturers, including their families, which we apprehend is not far from the true estimate. We shall, however, give the precise words of Mr. Law's speech in the house of lords on the above occasion, the object of which, it must be recollected, was to enhance the importance of the woollen manufacture. "In order to give your lordships some idea of its magnitude, I may venture to state, that there are no less than 1,500,000 persons who are immediately concerned in the operative branches of this vast manufacture; and if what Dr. Campbell states in his 'Political Survey of the Kingdom' be true, that from the wool-grower to the consumer a piece of broad-cloth passes through 100 different hands, and that there are nearly the same number of hands dependent on the woollen manufacture, though not actually concerned in it, I may assume that the trade directly and collaterally employs double the above number of hands, or 3,000,000. If we estimate the magnitude of this question (the export of wool) according

to the number of persons interested in it, it goes to nearly one-third of the entire population of this kingdom, estimating that population at what is generally reckoned, namely between 9 and 10,000,000." Though the woollen manufactures of England have considerably increased within the last fifty years, we do not apprehend the number of hands employed is greater than before the introduction of mechanical inventions for carding, spinning, and combing. The working up of one pack of wool, particularly of combing-wool, formerly employed a great number of hands, and was divided into small portions, to be spun in the houses of cottagers in remote districts. This afforded employment to the wives and families of labourers who were engaged in agriculture; but so much time was occupied in taking out and collecting in the work, that at the period we refer to, few, if any, of the master manufacturers in Yorkshire consumed more than one pack of wool *per week* in their trade. At present there are numerous manufacturers in Yorkshire and Lancashire, who consume from twenty to fifty packs of wool *per week*.

The cotton manufacture, which may be regarded as of recent date, has employed the population that would otherwise have been thrown out of work in the woollen trade since the introduction of machinery, and has prevented any inconvenience of this kind from being felt at present in Yorkshire. We may, however, observe, that many branches of the woollen and worsted trade have been gradually retiring from the south of England, and concentrating in the West Riding of Yorkshire and in Lancashire. These districts were the first to introduce mechanical improvements into the woollen manufacture, and thus gained a decided advantage over the more ancient seats of the woollen trade. For several years afterwards the effects were felt in the manufacturing districts in the west of England, and great distresses from want of due employment for the labouring classes was the consequence.

At present all kinds of machinery that have hitherto been applied to wool are extensively employed in the west of England, and the manufacture of superfine cloth is in a flourishing state in the counties of Gloucestershire, Somersetshire, and Wiltshire, all ancient seats of the clothing trade. The manufacture of broad-cloth in other parts of the south and west of England is not carried on to any great extent. The manufacture of flannels, serges, baizes, &c. though branches of the woollen manufacture, are distinct from the cloth trade, and seldom carried on in the same district.

The export of woollen goods of all kinds from England, in the year 1815, amounted in declared value to ten millions one hundred and ninety-eight thousand pounds. This was rather an extraordinary quantity; and in the following year the exports fell under nine millions, which may be taken as the regular annual amount of woollen exports at present.

The following table gives the amount of different kinds of woollens exported, with their value, and the places to which they were sent in the year 1816; a year in which our foreign trade was considered as in a declining state. It may be worthy of remark, that though our woollen exports scarcely reached eight millions and a half, the amount taken by the United States of America in that year exceeded three millions; a fact which proves the vast importance of the American market to our manufacturers.

WOOLLEN MANUFACTURE.

An Account of the Quantity of Woollen Goods exported from Great Britain, in the year ending the 5th possible, the various Articles,

Countries to which exported.	Quantity and declared Value of Woollen									
	Cloths of superfine, second, and inferior Quality.		Napped Coatings, Duffles, &c.		Caffimeres.		Baizes of all Sorts.		Flannel.	
	Quantity.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.
	Pieces.	L.	Pieces.	L.	Pieces.	L.	Pieces.	L.	Yards.	L.
Russia - - - - -	79671	777074	27	153	2180	19857	128	565	62436 $\frac{1}{2}$	5633
Sweden - - - - -	56 $\frac{1}{2}$	979	—	—	1	4	—	—	832	54
Norway - - - - -	588	4921	217	949	60	378	27 $\frac{1}{2}$	165	4335	389
Denmark - - - - -	717	7447	34	130	354	2308	—	—	8142 $\frac{1}{2}$	646
Poland - - - - -	2	45	—	—	—	—	—	—	100	10
Prussia - - - - -	83	1100	67	324	214	1544	3	18	1324	137
Germany - - - - -	9274	54042	27740	110457	27882	103534	200	580	144972	9494
Holland - - - - -	9892	53294	13374	63462	2374	9367	1741	11950	37928	3373
Flanders - - - - -	3164	23086	6586	29540	1575	7364	13	94	44555	4602
France - - - - -	73	721	—	—	67	910	$\frac{1}{4}$	3	1944	154
Portugal, &c. - - - - -	39854	292141	7466	38755	3931	30037	13114	80377	14859	1355
Spain, &c. - - - - -	3395 $\frac{1}{2}$	30286	1228	5071	930	5975	5584	38139	42554	4411
Gibraltar - - - - -	4344	32520	1270	6805	950	5415	883	4886	79720	8913
Italy - - - - -	7729	45360	2772	11765	658	3395	48	285	20623	1535
Malta - - - - -	8453	45964	1305	5466	811	4274	53	198	4730	537
Turkey and Levant - - - - -	185	2850	51	258	—	—	—	—	1450	160
Ireland and Isle of Man - - - - -	21734	327049	61	399	4008	60851	91	556	200707	18898
Isles, Guernsey, Jersey, & Alderney - - - - -	991	13975	93	515	20 $\frac{1}{4}$	194	140 $\frac{1}{2}$	540	25054	2213
Afia - - - - -	19433	407614	170	936	231	2777	330	1374	225487	28130
Africa - - - - -	1485 $\frac{1}{2}$	17396	498	2538	1122	6586	241	1460	14386 $\frac{1}{2}$	1209
America; viz. United States - - - - -	195124	1463028	19798	73143	39899	263284	4446	12787	2288758	187940
— British Northern Colonies - - - - -	32412	246504	1827	5544	2248 $\frac{1}{2}$	15442	1051	4227	484129	35971
— West Indies - - - - -	16649 $\frac{1}{4}$	114544	529 $\frac{1}{2}$	1926	2708	16991	8109	40098	69729	6451
— Foreign Continental Colon. - - - - -	33319	238796	5409	30863	2911	18888	13926	80236	12999	895
— Honduras - - - - -	30	337	—	—	50	312	—	—	700	53
Total - - - - -	488658 $\frac{3}{4}$	4201073	90522 $\frac{1}{2}$	388999	95184 $\frac{3}{4}$	579687	50129 $\frac{1}{4}$	278538	3792454 $\frac{1}{2}$	323163

WOOLLEN MANUFACTURE.

of January, 1817, distinguishing the Countries to which exported, and also distinguishing, as far as and their respective Value.

Goods and Yarn exported from Great Britain.

Blankets and Blanketing.		Carpets and Carpeting.		Stuffs, Woollen or Worsted.		Stockings, Worsted.		Sundry Articles consisting of Hosiery not described, Rugs, Cover-lids, Tapes, &c.	Woollens, mixed with Cotton.		Woollen and Worsted Yarn.		Total declared Value of the preceding.
Quantity.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.	Declared Value.	Quantity.	Declared Value.	Quantity.	Declared Value.	
Yards.	L.	Yards.	L.	Pieces.	L.	Doz. Prs.	L.	L.	Yards.	L.	Lbs.	L.	L.
6742	885	30863	6335	2261	4723	208 0	276	1234	12433	2188	—	—	818923
58	7	1240	421	15	25	4 9	9	21	—	—	—	—	1520
268	37	645	155	479	1096	41 4	62	319	1715½	426	—	—	8897
382	51	1047	297	891	1850	10 0	13	152	786	270	—	—	13164
180	20	1130	265	52	120	—	—	—	—	—	—	—	460
—	—	1832	485	188	382	3 0	3	1028	2260	652	—	—	5673
12660	1285	73579	17742	37748	80244	3936 9	5201	15052	135862	26041	—	—	423672
7690	600	28737½	5462	31447	62391	8636 10	10384	3986	19730½	3968	—	—	228237
6663	685	6162	754	5635	13326	5145 6	6499	3645	31785	9072	—	—	98667
15	4	352	88	345	1112	196 0	240	443	2338	686	—	—	4361
44745	5026	18043	3394	27472	72091	3417 0	4153	35206	25190	5919	—	—	568454
10152	1189	6064	1086	11644	29281	2840 0	3666	25931	5846	1505	—	—	146540
2150	219	2600	474	10659	24874	892 10	1029	13846	19593	4563	—	—	103544
570	68	2765	627	14852	37930	62 0	84	1060	2894	720	—	—	102829
100	15	317	83	3682	9603	87 0	113	693	3382	389	—	—	67335
650	70	13595	3366	1816	4222	20 0	42	104	—	—	—	—	11072
30500	4727	46894	12042	8150	20883	12453 0	14156	11582	121483	25444	523638	65613	562200
4280	638	7211	1555	837½	2319	650 6	916	280	548½	150	—	—	23295
23824	3956	9879	2312	187820	572325	629 0	1039	8863	4044	895	—	—	1030221
14190	1237	3718	645	1638¼	3353	1520 0	1477	1139	2940	813	—	—	37853
1265746	165729	526964	109529	202061	609628	69059 6	75513	47802	198268	21284	—	—	3029667
258359	32455	69563	14293	21362	55511	18709 4	22190	8995	24103	4410	8757	2086	447628
233597	22153	3080	768	13094	27649	837 6	1133	4916	215912	14973	—	—	251602
39320	3750	9946	2008	9810	21845	2483 0	2851	7746	54805	9928	—	—	417806
1860	120	—	—	14	28	7 0	11	—	—	—	—	—	861
1964701	244926	866226½	184186	593972¾	1656811	131849 10	151060	194043	885918½	134296	532395	67699	8404481

WOOLLEN MANUFACTURE.

If we state the amount of woollen goods exported to be about one-third of our own consumption, or from one-third to one-fourth, which is probably more correct, this would make the total value of manufactured woollens to exceed thirty millions annually. Of the woollen goods exported, the quantity consumed on the European continent scarcely exceeds three millions sterling in value, and a great part of that amount given in the preceding account was for army cloth. Hence it appears, that a very small proportion of the general population of Europe is indebted to this country for its woollens, including under the term both woollen and worsted goods. The increased demand for woollens of every description in England arises partly from the increase of population, but more from the increasing demand for articles of luxury or convenience. In the middle of the last century, carpets were scarcely to be seen in the country, except in the houses of the nobility; at present almost every house in England, except those of cottagers and the labouring classes, has carpets spread in some of the rooms. The consumption of worsted yarn in articles of furniture, and in the linings of carriages, and what is called horse millinery, is very great; add to which the people of England are better dressed than they were formerly. We may from all these causes state, that the home consumption of woollens, in proportion to our population, is double that of any other nation in Europe. To prove that we do not over-rate the proportion of woollens consumed at home, it may be sufficient to state, that the West Riding of Yorkshire alone manufactured, in the year 1817, nearly twice as many pieces of cloth as were exported in that year; but few woollen broad-cloths are made for exportation in the west of England, the manufactures there being principally fine and superfine cloth for home consumption, the value of which *per yard* on the average is much greater than that of the Yorkshire cloth. In the present state of Europe, we think it an encouraging circumstance to our woollen manufacturers, that so large a proportion of their goods are consumed at home, where the demand will remain certain; and again, that the United States of America take so considerable a part of our exports, as from the increasing population of these states, we may expect that the demand will be increasing for many centuries, and will soon exceed what it will be in the power of this country to supply.

In the year 1800, the woollen manufacturers of England were greatly alarmed at the liberty which was intended to be granted, of exporting wool to Ireland, and petitioned parliament against the measure. The grounds on which their alarms rested, were partly the preference given to the Irish, and partly the supposed facility that would be afforded to smuggling wool to the continent. Several manufacturers and wool-dealers from different parts of the kingdom were examined before the two houses of parliament; but neither in their evidence, nor in the speeches of the learned council, who were heard in support of the petitioners, can we trace any comprehensive or enlightened views of the subject. The objections urged against the export of wool were grounded principally on the practice of former reigns, particularly those of Edward III. and queen Elizabeth: but the facts we conceive were in opposition to the statements; for during the whole of the latter reign, in which our woollen manufactures were in a highly flourishing condition, the export of wool was freely admitted, on the payment of certain duties; and during the reign of Edward III., the prohibition to export wool under heavy penalties was confined to denizens and foreigners, in order to secure a larger amount of duties to the king, the former paying less duty on exports than natives; nor was it till the reign of Charles II. that the ex-

port of wool was strictly prohibited. All the former prohibitions were evadable by licences, which were readily granted for money. It is from this reign, therefore, we must date the prohibition to export wool, as forming an established law of the land; and it is not unworthy of remark, that immediately after this period, and to the time of the revolution in 1688, our woollen manufactures were in a very declining state, which proves that they had not derived much benefit from the measure. The policy of admitting the export of wool has been again recently agitated in parliament, and has renewed the alarm of the manufacturers. It is not by precedents drawn from former ages, but solely by the wisdom and justice of the measure, as applicable to one present condition, that a question of this kind should be determined. With respect to short or clothing wool, we believe that a permission to export it would not produce the least effect, as we already import these wools from almost every nation in Europe; it is not, therefore, probable, that foreigners would give a better price for them than our own manufacturers can afford. With long combing-wools, the case is somewhat different, as by the acknowledgment of the French themselves, these wools are wanted to mix with and improve their own. We apprehend, however, that as much is exported at present clandestinely in the form of worsted yarn, as the market may require, the free export of cotton yarn giving great facility for evading the penalty, by packing them together. The permission to export wool to Ireland, which was granted in 1800, has not been attended with any one of the fatal effects which our manufacturers anticipated; nor do we apprehend, that permitting the free export of wool under certain duties would be found to injure our own woollen trade.

In taking this view of the subject, which we trust is an impartial one, we readily admit that the permission to export wool, were it granted, would not be attended with any permanent benefit to the landed interest. A small pamphlet on the subject, recently published by John Maitland, esq., contains the following judicious observations:—"The manufacturer of our native wool claims from government the preservation of it for his use; for *by the statute law of the land, he is confined to its soil for the express purpose of working up the wool which grows upon it.* This wool cannot, therefore, upon any just or moral principle, be permitted to go out of the country in an unmanufactured state, without allowing the manufacturer to follow it, or without obliging the grower and exporter of it to maintain him and his children." This is so obviously just, that whenever the export of wool is admitted, we cannot any longer, as at present, prohibit the woollen manufacturers from emigrating and carrying their industry to the best market. "The wool," as Mr. Maitland elsewhere observes, "does not on an average compose more than one-sixth part of the value of the animal on which it grows; and the manufacturer, by obtaining this sixth part, at such a moderate rate as may enable him to sell his goods, when manufactured at a reasonable profit, infuses to the owner of land a moral certainty of obtaining the full value for the remaining five-sixths, and receiving an ample price also for all the other productions of his ground." The truth of this observation we know to be fully proved in the Yorkshire markets. Whenever there is any considerable depression of the woollen trade, it is always attended with a decreased consumption of animal food, supplied principally from Lincolnshire, and the counties which produce the largest quantity of wool. Should the permission to export wool be attended with any effect in diminishing our own manufactures, the result would be highly injurious to the land-owner, who would then have to find new customers for his

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his general produce, and new associates to share with him the burden of taxation.

The prices of heavy combing-wool in Lincolnshire, Nottinghamshire, or Leicestershire, may be taken as the average price of this kind of wool over the whole kingdom, there being little variation in the value of this wool from different districts. The following table will shew what have been the prices for a great part of the last century :

Price *per* Tod of Lincolnshire Fleeces, the Tod weighing 28 lbs.

	£	s.	d.
1706	-	0	17 6
1707	-	0	16 6
1711	-	0	13 0
1713	-	0	17 0
1714	-	0	18 0
1715	-	0	18 0
1716	-	0	19 0
1717	-	1	3 0
1718	-	1	2 3
1719	-	1	2 0
1720	-	1	0 0
1721	-	1	0 0
1722	-	1	0 0
1723	-	0	17 6
1724	-	0	16 0
1725	-	0	16 0
1726	-	0	15 9
1727	-	0	16 0
1728	-	0	18 0
1729	-	0	18 0
1730	-	0	18 0
1731	-	0	19 0
1732	-	0	19 0
1733	-	0	18 6
1734	-	0	16 0
1735	-	0	14 0
1736	-	0	14 0
1737	-	0	14 0
1738	-	0	13 6
1739	-	0	13 0
1740	-	0	14 0
1741	-	0	14 0
1742	-	0	15 0
1743	-	0	19 6
1744	-	1	1 0

From the year 1744 to the year 1777, the prices, though occasionally fluctuating, continued much the same as in the preceding years, but we have not the means of ascertaining precisely what they were in each year. The following table will shew the prices of Nottinghamshire and Leicestershire heavy combing-wool, taken from the most authentic source. We consider the value of this wool to have been fully equal to that of Lincolnshire on each year.

Price *per* Tod of 28 lbs. of Nottinghamshire and Leicestershire heavy Combing-Wools.

	£	s.	d.
1777	-	0	18 0
1778	-	0	15 0
1779	-	0	11 0
1780	-	0	11 6
1781	-	0	10 6
1782	-	0	9 0
1783	-	0	12 0

	£	s.	d.
1784	-	0	16 0
1785	-	0	12 0
1786	-	0	13 0
1787	-	0	17 6
1788	-	0	17 0
1789	-	0	18 0
1790	-	0	18 0
1791	-	0	19 6
1792	-	1	2 6
1793	-	0	18 0
1794	-	0	17 6
1795	-	0	19 0
1796	-	1	1 0
1797	-	1	0 6
1798	-	0	18 0
1799	-	1	1 6
1800	-	1	4 6
1801	-	1	10 0
1802	-	1	10 0
1803	-	1	9 0
1804	-	1	12 0
1805	-	1	13 6
1806	-	1	12 0
1807	-	1	4 6
1808	-	1	4 6
1809	-	1	8 0
1810	-	1	10 0
1811	-	1	5 0
1812	-	1	10 0
1813	-	1	14 0
By the end of the year	-	2	5 0
1814	-	2	2 0 to 2 12 0
Spring of 1815	-	2	16 0
1815	-	2	10 0
1816	-	1	10 0
1817	-	1	14 0 to 2 0 0

The above were the average prices of the best lots ; the inferior ones might range from one to two shillings *per* tod under the prices here given. It may be observed, that the price of this kind of wool was lower towards the close of the American war, or about the year 1781 and 1782, than in any former or subsequent period of our history, if we take into consideration the relative value of money. At that time, the quantity of wool unfold in the hands of the farmer was nearly equal to three years annual growth ; a quantity too large to have been consumed by our manufacturers, had not the introduction of machinery enabled them to work it up with much greater facility than formerly. The average weight of these fleeces may be stated at four or seven pounds each fleece to the tod of 28 pounds. Since the commencement of the present century, the price of this kind of wool, it will be seen from the above table, has been amply sufficient to remunerate the wool-growers ; and we confess we are utterly at a loss to discover on what grounds of sound policy or interest they would wish to make any change in the laws respecting the export of wool. With respect to short or clothing wools, any change in the existing laws would make no alteration whatever in the price ; for it is the extreme of prejudice to assert, that our native clothing fleeces are necessary to the foreign manufacturer, either to supply his demand or improve the quality of his own wool. We might with equal justice revive the absurd opinion, so confidently maintained a few years since, that the best Spanish wool would not make cloth without an admixture with that of England.

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WOOLLEN Manufacture, Procefs of. In an early part of this work, under the article CLOTH, we have given a general view of the procefs of cloth-making, furnished by a principal manufacturer in the west of England. In the present article, we shall confine our account chiefly to those improvements in the processes which have since been introduced, and shall add a description of the machines which were only slightly noticed in the article CLOTH, and give references to the plates. The processes of the woollen manufacture may be classed under two heads; those by which wool is prepared for the weaver, and those by which the cloth is finished after it is taken out of the loom. The sorting of wool has already been referred to under the article WOOL. English wool is supposed to be sufficiently cleaned from pitch marks or other extraneous substances by the wool-sorter, and left by him in a proper state to commence the process of cloth-making. Spanish wool in the bale has generally some part of the pitch employed to mark the sheep still adhering to it, which must be carefully cut off. It was till recently the practice to beat the wool with rods, in order to shake out the dust and open the staples; but this is now principally done by an opening machine with long coarse teeth, called a devil, or wool-mill. Spanish wool is frequently so hardly pressed together in the bag, that it requires to be opened out by beating, to prepare it for the further processes.

In the west of England, wool is generally scoured before it is dyed or carded; but in Yorkshire this is seldom practiced on wool intended for white cloths, and among the smaller manufacturers who dye their own wool, it is frequently put into the dyeing-vat unscoured; a practice which injures the brightness of the colours, but which enables the manufacturer to make a greater weight of cloth with the same quantity of wool. There is also some saving of labour and expence; but this is more than counter-balanced by the increased quantity of oil *per pack* required for unscoured wool, which is at least one-third more than would be necessary if the wool were scoured. In the west of England, where the wool is scoured previously to its manufacture, the process is carried on with a degree of neatness and cleanliness, which form a perfect contrast with the horrid stench and disgusting filthiness of the woollen factories in Yorkshire. For fine cloths, olive-oil, called Gallipoli, from the part where it was supposed to be sent, is principally used; and for the coarser cloths rape-oil. Where attention to colour is not required in very coarse goods, fish-oil is sometimes employed; but if the latter remain in the wool or cloth, it turns it brown, undergoing a degree of fermentation injurious to the cloth, and which sometimes occasions spontaneous combustion. To lessen the expence of oil for coarse cloths, some manufacturers in Yorkshire make use of a mixture of soap and water with oil, which answers very well in moist weather, if the wool be immediately carded and spun; but if it remain some time unwashed, or the weather be very hot, the mixture evaporates. It has been attempted to work wool without any oil whatever, but without success. The use of oil is to cover the surface of the fibres, and enable them to slide easily over each other in carding or spinning. What we have before said of the structure of the surface of wool or hair, under the article WOOL, will suffice to shew the advantage that must result from oiling. The wool is sprinkled with oil as evenly as possible. In Yorkshire the proportion on fine wool is about six gallons *per pack*, and this is more equally distributed over it by the wool-mill, through which it passes previous to the processes called scribbling. This process is a kind of coarse

carding, and is performed on a machine similar to that used for scribbling cotton, but larger, and with coarser cards, the principle being similar to that of the carding-machine, hereafter to be described. By this engine the longer fibres are broken down, and they are all laid straight and nearly parallel to each other. The wool leaves the roller of the scribbling-mill in one thin undivided sheet, and the more clear, even, and transparent it appears when held between the eye and the light, the more perfectly has the operation been performed. On the carding-engine, the operation is repeated on finer cards; but instead of leaving the machine in one continued sheet, it is finally divided into separate portions, which by a fluted roller are formed into separate round pieces about one inch in diameter, and two feet three inches in length. The fibres are now arranged so as more easily to slide over and twist round each other in the next process, which is a kind of coarse spinning called *slubbing*, performed with the *slubbing-machine*, which will be described. On this machine each of the rolls from the carding-machine are joined together, and drawn out into a loosely-twisted thread, and wound round a spindle, forming what is technically called a *slubbing*. These *slubbings* being taken to the spinning jenny, which will also be described, are twisted in an opposite direction, and drawn out into threads of yarn of the requisite length. For very fine yarn used in shawls, a machine called the mule is sometimes employed, nearly similar to the cotton mule (see *Manufacture of COTTON*), the *slubbing* passing through rollers which assist in drawing out the thread smaller and more regular. The yarn is now prepared for winding, sizing, warping, and weaving. (See CLOTH.) Since the article CLOTH was written, broad-cloth is almost universally woven by one person only in a loom, making use of the fly-shuttle. (See WEAVING.) The next process is scouring and burling, already described under the articles CLOTH and FULLING. The cloth is then sent to the fulling-mill; the finer kinds are prepared for fulling by a mixture of soap and water; in coarse kinds, fuller's-earth supplies the place of soap. (See FULLING-Mill, and a farther description at the end of the article.) The principle on which the felting depends has been described under the article WOOL. By the process of fulling, the cloth becomes shortened in length and breadth, and the fibres are incorporated and intimately united with each other. In the best manufactured cloths, this incorporation is so complete, that the separate threads can scarcely be distinguished, the bottom of the cloth appearing to form one even continuous substance. An improvement in this respect has recently been made at Leeds, by spinning the wool much softer and thicker than has usually been the practice, and uniting the threads in the fulling-mill, and then working the substance of the cloth down to a requisite degree of thinness by the gig-mill, hereafter to be described. At the end of the process, the face or surface of the cloth is much softer, and greatly superior in appearance to cloth manufactured in the common process. A pack of wool of 240 lbs. will make when milled about one hundred and twenty yards of mixed or coloured cloth from fifty to sixty inches in breadth, according to the quality and fineness of the wool. The processes of raising, shearing, and pressing, have been mentioned under the article CLOTH, and will be more fully described when an account is given of the gig-mill and shearing-machine. The object of these processes is to cover the thread with a soft pile, consisting of the fibres of the wool, cut down to an even surface over the whole piece.

There are various kinds of woollen goods worked on the same principle as cloth, and made with both the warp and the weft

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weft of carded wool, but which being unmilled, or finished in a different manner, receive different names. Blankets are manufactured on the card, but from wool that possesses a greater length of staple, and which therefore admits of a deeper pile, being raised on the surface. The yarn is spun thicker, and left as soft as possible, in order that it may form a full cover or pile. Fine blankets are made much stouter and heavier than coarse ones; they are both scoured in the mill, but are scarcely suffered to undergo the fulling process. Thick cloths with a long pile, called duffields, fearnoughts, and bear-skins, are manufactured on the same principle as blankets, but they are milled much thicker and dyed, and also raised to a deeper pile. Flannels and very light cloths, such as Bath coatings, are usually spun small, in proportion to the quality of the wool. In weaving plain cloths, the chain or warp is equally divided by the gears, one half of the threads being above and the other half below, and they cross each other every time the thread of the weft is thrown through by the shuttle. In weaving kerseymeres or cassimeres, on the contrary, the warp is unequally divided, to produce what is called the twill, or tweel, (see *WEAVING*,) one-third being always above and two-thirds below the shuttle as it passes. It is owing to this arrangement of the warp, that it forms a slanting or diagonal rib across the body of the cloth, which is the distinguishing character of this kind of woollens. See *DRAUGHT of Looms*.

Cassimeres are usually set in the loom from thirty-four to thirty-six inches wide, and milled to twenty-seven inches. Forty pounds of wool from the bag will make rather more than sixty yards of common milled fine cassimeres; the double milled ones make less in proportion to the degree of milling they receive.

Swandowns and tolinets are made with a cotton warp; the weft is woollen or worsted yarn of various colours, according to the patterns required. Woollen cords have also the warp of cotton and the weft of woollen; they are woven and cut precisely in the same manner as cotton cords. See *FUSTIAN*.

Serges are made with the warp of worsted and the weft of coarse woollen yarn, and are twilled. These goods have been for a very long time manufactured extensively in Devonshire, and are principally purchased by the East India company for the China trade.

Carpets have worsted warps and woollen wefts. See *CARPET and WEAVING*.

From the most remote period of the woollen manufacture until the latter end of the last century, or about the year 1780, very few, if any, mechanical improvements had been introduced into it. During the whole time the various processes were carried on nearly in the same manner, but with greater or less skill, and were employed upon materials more or less valuable. The carding and spinning of wool, and the weaving and finishing of cloth, in the early part of the reign of George III., were effected by the same machines as in the time of Edward III., which probably were similar to those of the ancient Romans, but more rude in their construction. In an art which had seen so many centuries roll on without any change, it did not appear possible to the manufacturer that any improvement could be effected; and had not the genius of Hargreaves and Arkwright changed entirely the modes of carding and spinning cotton, the woollen manufacture would probably have remained at this day what it was in the earliest ages of civilized society. That it would have been better for general society if it had so remained we readily admit; but after the improved modes of working cotton were discovered, this was impossible. The spinning jenny, which was the same as that employed in

the cotton manufacture, but somewhat larger, was introduced into Yorkshire from Lancashire about the year 1780, but did not become general till about three years afterwards. In the first jennies, not more than eighteen or twenty threads could be spun, and the mode of winding the thread upon the spindle was very imperfect. The carding was still effected by the hand, and the slubbing or roving was prepared on the common spinning-wheel. For some time considerable difficulty was experienced in carding by machinery, particularly in clearing the wool from the card; and a slight change in the construction of the machine was found necessary to prepare the wool for the slubbing-billy, of which an account will be given in the description of the carding-machine. Soon after this, the carding and spinning of wool and yarn by machinery became general through the manufacturing districts of the West Riding of Yorkshire, and large mills were erected, in which the carding and scribbling machines were turned by a water-wheel, and the roving or slubbing performed on the billy. The wool carded at these mills was sent to the smaller manufacturers in the state of slubbing, and the farther process of spinning was effected on jennies in their own premises. Before the year 1787, the old processes of carding by the hand, and spinning on the wheel, were entirely discontinued in Yorkshire; but it was some years after before the new processes were generally introduced in the west of England, and thus, as we have before stated, the woollen trade became more concentrated in Yorkshire, where cloths could be manufactured at less expence. About this time, machinery began to be applied to the combing and spinning of long combing-wool, to make worsted yarn. See *WORSTED Spinning*.

In consequence of the great increase of trade in Yorkshire, it was found difficult to obtain situations for mills to be turned by water, and the application of the steam-engine to woollen machinery became very general. The abundance of fuel was highly advantageous to the Yorkshire manufacturer; and it was found to be equally cheap to work the machines by steam as by water, where any considerable rent was paid for the water. The motion of the improved steam-engine was also rendered as regular as a water-wheel, and the great inconvenience and loss from the interruption of the works by frosts or continued droughts were thereby avoided.

The smaller manufacturers in Yorkshire were at first benefited by the introduction of machinery, but in a little time large capitalists began to engage in the woollen trade, and performing all the processes with their own machinery, they were enabled to work cheaper and undersell the smaller makers. The facility also with which wool could now be worked up kept the markets always well stocked with goods, and prevented the manufacturers from taking the advantage of a temporary scarcity or a brisk demand, which they had formerly done, an overstocked market always reducing the profits.

Soon after the year 1800, the number of small manufacturers began rapidly to decrease many of them, being ruined by the change which had taken place, and compelled to become workmen in the factories of the large capitalists.

The gig-mill and the shearing-machine were not introduced into Yorkshire until they had been several years employed in the west of England, owing to the resistance made to them by the working cloth-dressers or croppers in the north.

The manufacture of worsted is properly a branch of the woollen manufacture, and noticed as such in our history of its progress in England; yet the mode of manufacture, both in preparing the worsted yarn and finishing the goods, being entirely

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entirely different from woollens made of carded wool, and part of it being applied to hosiery, we refer, for a further account of it, to the articles *WORSTED Manufacture*, and *WORSTED Spinning*.

Description of the Machines employed in the Woollen Manufacture.—The *wool-mill*, or *willy*, is the first machine which is employed on the raw wool to open and disentangle the close matting, in which the wool comes from the wool-stapler. It is also used for clearing the dyed wool from the dye stuff, and again for mixing different parcels of wool together; also for incorporating the oil with the wool.

The wool-mill used in Yorkshire consists of a cylindrical drum, about three feet long and two feet and a half diameter, which is made to revolve near three hundred times *per* minute. Its circumference is furnished with teeth or spikes, and immediately above it five small rollers are placed, which are also furnished with similar teeth. The teeth of the rollers and those of the drum intersect each other when they all turn round; and the teeth of the five small rollers also intersect each other. The cylinder and rollers are inclosed in a box or case, which is closed on all sides, except a door in front, which turns down, the hinges being at the lower side. When this door is shut up it stands in a perpendicular plane, very near to the teeth of the drum; when the door is opened, or turned down into the horizontal position, the wool is laid upon it, about one pound weight at once, and the door being closed the wool is brought within reach of the teeth of the cylinder, which take the wool and carry it upwards, so as to work it between the teeth of the cylinder and those of the five rollers placed over it. This effects the opening of the wool, and breaks the fibres if the staple is too long: it also separates the matted fibres. In about three seconds, the pound of wool is generally sufficiently worked, during which time the cylinder has made about fifteen turns. The lower part of the case in which the cylinder revolves is a grating of wooden rods, through which the dirt and dust escape. The cylinder is fitted very close to this grating, so that the wool cannot escape from the cylinder, but is carried round in it, and is thus repeatedly submitted to the action between the teeth of the cylinder and those of the rollers. When it is judged that the wool is sufficiently worked, the door is opened again, and the centrifugal force throws out the wool in an instant; a fresh charge is then laid upon the door, and shut up in the machine. A preferable mode is to have two doors on opposite sides of the case; one to put in the raw wool, and the other for the finished wool to come out at.

The wool for coarse goods is passed several times through the wool-mill; first, to break the mats of the raw wool and render it light; then a second time after it is dyed; a third time to mix the different sorts together; and lastly, after the wool is oiled, it is passed a fourth time through the wool-mill, with a view to incorporate the oil well with the fibres of the wool.

Scribbling-Machine.—This is the first stage of carding. The operation tends to disentangle the fibres which were before closely entangled, and draw them out separately, so as to render the wool light and flaky. The scribbling-machine is very similar to the carding-machine, having a large cylinder or drum, which is covered on the surface with sheets of leather stuck full of projecting wire-teeth, called card-wires. The teeth are so close together as to cover the whole surface of the cylinder, like the bristles of a brush. This cylinder is turned rapidly round by the machinery, and the wool is regularly and slowly supplied by feeding machinery to its teeth, which take it up, and the cylinder, as it were, clothes itself with wool. This wool is carded or worked by

the teeth of several other smaller cylinders, called workers and clearers, which are fixed around the great cylinder in pairs. The teeth of the workers take the wool from the great cylinder, and give it to the clearers, which return it again to the great cylinder. It is then transferred to another worker, and by its clearer is given back to the great cylinder, and so on. It is by the repeated transferring of the wool from one cylinder to another, that the chief action of scribbling or carding is performed. The teeth of the different cylinders do not actually touch each other, but they work so near together, that the fibres of the wool which the teeth of one card contains are caught by the teeth of the other card, and drawn out a very few at a time. This action tends to separate the fibres, and renders the wool light and open, and also distributes the wool with great evenness over the surfaces of the cylinders. After the wool has passed between three or four pairs of workers and clearers, it is taken up by a cylinder, called the doffer, which is smaller than the great cylinder, and turns round very slowly. The wool is stripped off from this doffer by a steel comb, which is situated parallel to the axis of the doffer, and is moved rapidly up and down by a crank through a small space. In ascending, the comb does not touch the doffer; but when the comb makes its down stroke, it comes in contact with the teeth of the cards, and combs out almost all the wool they contain. As the doffer turns round very slowly, and the comb acts at small intervals, the successive portions of wool which it combs or strips off, hang together in a continued fleece or web of a very thin texture, which hangs down from the doffer, and is received in a basket.

The wool in this state is said to be scribbled, but the fibres are not yet sufficiently combed out or separated; for on examination of the scribbled wool, many small knots and films of wool are found, which are still closely entangled. The scribbling is therefore repeated twice or three times, and then the wool undergoes another operation, which is called carding, but which is very nearly the same as the scribbling, only the wool is formed into small cylindrical rolls, which are the first rudiments of a thread.

We have thought it needless to give a drawing of a scribbling-machine, as it may be readily conceived from the following description of the carding machine.

Carding-Machine. (See *Plate IV. Woollen Manufacture.*)—A is the wood frame of the machine, but the best machines have cast-iron frames; C C is the outside of the large cylinder, which is about thirty inches diameter, and twenty-six inches wide: its axis is supported on bearings at each side of the frame, and it is put in motion by an endless strap applied upon a pulley at one end of its axis, which pulley cannot be seen in the figure. The cylinder revolves about 100 times *per* minute. B is an arch of wood to receive screws, which support the six small cylinders marked 2 a and 2; these are the workers and clearers. The workers 2 a are larger, and turn slower than the clearers 2; each worker is acted upon by its clearer, and both worker and clearer act against the cards of the great cylinder.

The raw wool is spread evenly upon the feeding-cloth 5, at one end of the machine: it is an endless sheet stretched over two rollers, one of which has a cog-wheel G upon the end of its axis, and receives motion from a pinion situated behind the pulley F. This pulley is turned by an endless cord passing round a pulley n, fixed upon the cog-wheel E, which is turned by a pinion 8 on the end of the axis of the great cylinder. The wool which is spread on the cloth 5 is taken off, between a pair of feeding-rollers, which are clothed with cards laid on in spiral fillets. These rollers cannot be seen, being within the frame; they are about 2½ inches

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inches diameter, and are turned round by toothed pinions on the axis of the cloth-roller, so as to move rather quicker than the feeding-cloth. The feeding-rollers give the wool to a cylinder 4 *a*, called the carrier, which is about nine inches diameter. The carrier works against the cylinder C; but as its surface moves more slowly than the surface of the cylinder, the wool contained in the teeth of the carrier is taken up by the cylinder. The carding-machine represented in our plate is shewn with a cylinder 3, beneath the carrier; this is not used in the present machines, but the feeding-rollers give the wool at once to the carrier 4 *a*.

That part of the cylinder which is adjacent to the carrier moves upwards, so as to carry up the wool it has taken from the carrier, and give it to the workers 2 *a* and clearers 2. The surfaces of the workers 2 *a* move in the same direction as the surface of the great cylinder, but they turn slowly, being put in motion by the chain 9, which passes over wheels at the ends of all the three workers. These wheels have cogs or teeth to enter into the links of the chain, and prevent it from slipping; the chain passes beneath a wheel fixed on the axis of the cog-wheel E, but within the frame. The wheel E is turned by a pinion 8, fixed on the extremity of the axis of the great cylinder; and the proportions are such, that the workers 2 *a* revolve once to about four turns of the great cylinder, and the workers being about 6½ inches diameter, whilst the cylinder is 30 inches diameter, the surface of the cylinder moves about 18½ times as fast as the surfaces of the workers.

The small rollers 2, called clearers, are placed so as to card the wool on the workers, and on the great cylinder also. The clearers are turned round very quickly, and take the wool from the workers, but their surfaces do not move so fast as the surface of the cylinder. Thus the strap 13 passes over a wheel of about 8½ inches diameter, fixed on the extremity of the axis of each clearer; this strap is put in motion by a wheel of about 22 inches diameter, fixed on the axis of the great cylinder; therefore, the clearers turn about 2½ times to one of the great cylinder; but as they are only 3¾ inches diameter, and the great cylinder is 30 inches diameter, the surface of the cylinder moves near 3½ times as fast as that of the clearer. The carrier 4 *a* is turned by the same strap 13; but being larger than the clearers, its surface moves much quicker, so that the cylinder's surface moves only about once and a half as fast as the carrier's surface.

The strap 13 also turns a cylinder 2, at the right-hand end of the machine, called the fly: its surface moves the same way as the surface of the cylinder, but moves nearly once and a half as fast; the pulley at the end of the fly being only 4½ inches diameter, and the fly itself nine inches. The fly is not placed so close to the cylinder as to take the wool away therefrom, but is intended to raise and loosen it in the cards of the cylinder, so that the cylinder 4 beneath it, called the doffer, can take off the wool more readily. This doffer is 14 inches diameter, and is covered with separate sheets of card-wire, each about 4 inches wide, leaving vacant spaces between them parallel to the axis of the cylinder. The doffer moves round very slowly, its surface moving only ¼ of the velocity of the surface of the cylinder: it is turned by a band from a pulley on the axis of the roller D, which we shall next describe.

The comb which works against the surface of the doffer, and strips off the wool from it, cannot be seen in the drawing. The comb is supported by two upright rods, screwed to it one at each end; the upper ends of these rods are guided by two horizontal levers, and the lower ends are jointed to two small cranks formed on an horizontal axis, which is situated at the lower part of the frame near the

ground, and put in rapid motion by a strap, from a pulley at the bottom of the frame beneath the great cylinder. This pulley has a smaller one fixed on the extreme end of its axis, and receives its motion from the same strap 13, which turns the clearers. Every revolution of the cranks causes the comb to rise and fall about two inches; and when the comb descends, the teeth on its edge act against the cards, on the surface of the doffer 4, so as to take out the wool from them. This wool is separated in a continued sheet or film, because the strokes of the comb succeed each other very quickly, and the doffer turns round slowly; but owing to the vacant spaces between the cards on the doffer, this film only continues for a width of about four inches, and is then discontinued until the vacant space on the doffer has passed by the comb, which then acts again to strip off the wool, and so on: hence the wool is drawn off from the machine in a carded state, in small and very delicate films or webs of about 4 inches wide, and 27 or 28 inches long, which is the length of the doffer.

These detached portions of wool are next rolled up so as to form small cylindrical rolls, which is done by what is called the roller-bowl D: it is a cylinder of wood, with shallow flutes upon its surface, parallel to its axis; it is turned round slowly by a pulley H on the end of its axis, and an endless band, 14, which passes round a pulley I, fixed on the wheel E. The lower part of the roller-bowl, D, is inclosed within a hollow cylinder of wood, called the shell; it encompasses the lower half, being fixed beneath the revolving cylinder; the shell is fluted within side, but does not touch the bowl, leaving a small interval between the two. The portions of wool, as they are stripped or combed off from the doffer, fall down over the edge of the shell, which for that purpose is situated close to the doffer, at that part of its circumference where the comb works: by this means, the wool which is stripped off falls down into the space between the shell and the roller-bowl; and when the portion of wool is completely detached and drops off, the motion of the bowl within its shell rolls the wool between them with a rolling motion, which forms the wool into a very round and straight cylindrical roll, called a carding, when these cardings drop out from between the roller-bowl and its shell; they fall upon a flat table, *a a*, as shewn at 7 7 7. This table is covered with an endless cloth, which is stretched over two horizontal rollers; one of these rollers has a cross, marked 16, 16, fixed on the end of its axis; the arms of the cross are seized by a cranked lever, 15, which is fixed to the axis of the roller-bowl, and at every revolution the cross 16 is turned round one-fourth: this moves the endless cloth forwards, and carries the cardings away in the manner shewn at 7 7 7, as fast as they drop out from the shell, and from this table they are carried away to the slubbing-machine, or billy.

In most modern machines the latter movement is altered, the endless cloth being kept in a continual and slow motion by an endless band passing round a small pulley fixed to the pulley H, and a larger pulley fixed in place of the cross 16.

In some old carding-engines many of the motions were performed by toothed wheels and pinions; but of late years all the parts are moved by bands or straps, which produce a much more equable and steady movement. The large cylinders are generally made by placing two or more wheels of cast iron on one axle, the circumference of the wheels being cased with wood, which is attached to them by screws or rivets. The smaller rollers are formed in a similar manner on wooden disks, but all are made hollow, to avoid warping, which would render the action of the cards irregular and uncertain.

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We must now return to the scribbling-machine: it is the same as the carding-machine, except that the breadth of the cylinder is greater, and the teeth are coarser; there is no roller-bowl D, and the doffer 4 is completely covered with cards, without any breaks or intervals; hence the film of wool which is taken off is continuous, and is suffered to fall down into a basket.

Double Scriblers.—In Yorkshire it is common to employ double scriblers; that is, two of the machines combined together, and placed in one frame; there are two large cylinders, each surrounded with its workers and clearers, and doffer, as we have described, making in all seventeen small cylinders. The first great cylinder has a feeding-cloth and carrier, to supply the wool to the cylinder; but the second large cylinder is supplied with wool from the doffer of the first cylinder, which doffer serves in place of a carrier to the second; it therefore has no comb. The doffer of the second cylinder has a comb to take off the wool, which then falls into a basket.

This machine is said to save trouble of attendance, and does more work than two single machines. The usual practice is to pass the wool once through the double machine, and then once through a single machine. A double machine will scribble about a hundred weight of wool *per* day.

After the wool is scribbled it is weighed, and when it is taken to the carding-machine, a certain weight is spread over a certain length of the feeding-cloth, so as to supply the wool to the machine with perfect regularity. The proper weight which should be allowed is ascertained experimentally, according to the fineness of the thread which is required to be spun. The cardings are weighed from time to time, to ascertain if each one contains the proper quantity of wool.

The cardings produced by the united operations of scribbling and carding are composed of fibres of wool laid very lightly together with the least possible entanglement; they are very regular and even in size, and upon this circumstance the perfection of the spinning chiefly depends.

Slubbing-Machine, or Billy.—This performs the first process of spinning. It reduces the cardings, and draws them out in length; joins them together, and gives them a slight twist, in order to form a coarse and loose thread, called a slubbing or roving, which must be spun over again in the jenny, to make a thread fine enough for the loom.

This operation was formerly performed by hand on the common hand spinning-wheel, which is similar to that used for spinning wool, but of a smaller size. Machines were then contrived by which a number of slubbings could be drawn out together; but the aid of the hands was required for joining the rolls or cardings of wool together in succession, and for other purposes, which were found to take so much time, that very little, if any, saving of labour was effected by the use of such machines.

A perspective view of the slubbing-machine, now universally employed, is given in *Plate I. Woollen Manufacture*. A A is the wood frame of the machine; within this frame is a moveable carriage, D D, which runs upon the lower side-rails at a a, with wheels 1, 2, to make it move easily; and it is capable of running backwards and forwards in the frame from one end to the other. The carriage contains a number of perpendicular spindles, marked 3, 3, which are put in rapid motion by a long cylinder F, and a separate band from each spindle, which passes round a small pulley on the spindle. The cylinder F extends horizontally across the whole breadth of the carriage; it is made of tin plate, hollow like a tube, and covered with paper on the outside.

The spindles are placed in a frame, so as to stand nearly perpendicular, at about four inches from each other; their

lower extremities are sharp-pointed, and turn in sockets, and they are retained in their perpendicular position by a small collar of brass for each, which surrounds the spindle at about the middle of its length. The upper half of each spindle projects above the frame, and on the lower part the small pulley or whirl is fixed, to receive the band from the horizontal cylinder, which is about six inches in diameter, and a little longer than the row of spindles; it is placed before them with its centre at a lower position than the row of whirls. The cylinder receives motion by a pulley at one end, with an endless band from a wheel E, made like the large wheel used in spinning wool by hand, and of the same dimensions. The wheel is situated at the outside of the great frame of the machine, and its axis is supported by upright standards erected from the carriage D; the wheel is turned by the left-hand of the spinner, applied to a winch, which is plainly seen in the drawing, and gives motion to the cylinder F, which again turns all the spindles at once with a great velocity.

Each spindle receives a thread, or slubbing, which threads issue from beneath a roller, C C, at one end of the frame, and proceed to the row of spindles placed in the carriage, so that the slubbings are extended nearly in an horizontal direction. The spindles, by the motion of the carriage, are capable of advancing or retreating from the roller C, so as to extend any required length of slubbing.

The cardings of wool, which are to be spun into slubbings, are extended side by side upon an endless cloth, which is strained in an inclined position between two horizontal rollers, one marked B B, and the other cannot be seen. There is one carding for each spindle, and the number is usually from 50 to 80. C is a light wooden roller to bear upon the cardings which lie upon the cloth, and press slightly upon them by its weight. Immediately before this roller is a wooden rail G, and another beneath it, which is fixed horizontally across the frame: the cardings are conducted between these two rails, the upper of which is capable of rising; but when it falls by its weight, it holds the cardings fast between the two, and hence these rails are called the clasp; the upper moveable rail G of the clasp is guided between sliders, and a wire 7 descends from it to a lever 6. When the carriage D is wheeled close home to the end of the machine, a wheel 5 lifts up the end 6 of the lever; and this, by the wire 7, raises the upper rail G so as to open the clasp, and release all the cardings: in this state, if the carriage is wheeled or withdrawn back from the clasp, it will draw the cardings forward. There is a small catch which receives the upper rail G of the clasp, and bears it up from falling until the carriage has retreated a certain distance, and drawn out about eight inches length of the cardings; a stop on the carriage then comes against the catch and withdraws it; the upper rail of the clasp G then falls and holds the cardings fast, whilst the carriage continues to recede, and draw out or stretch that portion of each carding which is between the clasp and the spindle. All this time the wheel is turned to keep the spindles in motion, and give twist to the cardings in proportion as they are drawn out, by which means it is prevented from breaking; because as the carding diminishes in size, and increases in length, the increasing twist combines the fibres of the wool, so as to give strength to the coarse thread or slubbing which is thus produced.

The slubbing is lapped round the spindle, but the clasp being higher than the upper ends of the spindles, the direction of the slubbing is not quite at right angles to the spindle; hence the spindle, when it is turned round, will give twist to the slubbing, without winding or gathering it

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up upon the spindle, because the slubbing always slips over the top-end of the spindle; but when a portion of each slubbing is finished, and it is required to wind it up round the spindle in a ball, the slubbing must be pressed down by a wire 8, so as to bear it from the point of the spindle, and place it opposite to the middle part of the cop or ball upon the spindle, and then the motion of the spindle will cause it to wind up upon the spindle, and form a ball.

The wire 8 is made to operate upon the whole row of slubbings at once, and for this purpose a horizontal rail 4 is placed in the front of the row of spindles, being provided with pivots at its extreme ends, on which it is supported in standards rising from the carriage D. It has a small arm or lever projecting from it at each end, and the wire 8 is stretched between these arms. By turning the rail 4 round upon its pivots, the wire is capable of being raised up, as in the figure, or lowered down at pleasure: when the wire is lowered, it descends below the level of the top of the spindles, so as to bear down the threads which, when the wire is raised up, as shewn in the figure, proceed from the points of the spindles.

The spinner holds the rail 4 in his right-hand, and it is by this that he draws the carriage either in or out, according as it may require; and by turning the rail 4 round, he can elevate or depress the wire 8, so as to make it bear down the slubbings to any degree at pleasure; by this means, he distributes the slubbings upon the spindles in a proper manner, to form a regular ball or cop, as shewn in the figure.

As the cardings are very slight and tender, they would be liable to break if they were dragged forwards on the inclined cloth, or even if the cloth were to be moved round its roller by the force applied to the cardings. To avoid this, a cord is applied round a groove in the middle part of the upper roller, and after passing over proper pulleys, as shewn in the drawing, it has a weight suspended to one end, and a smaller weight to the other; the small weight is only to keep the rope tight, but the large weight tends to turn the rollers and endless cloth round in a direction to deliver out the cardings, so that there will be no strain on them. Every time that the carriage is wheeled home, the large weight is wound up by means of a piece of wood projecting from the carriage, which seizes a knot in the cord at the part which lies horizontally; this pushes the cord back a certain distance, so as to draw up the great weight; but the endless cloth cannot turn backwards, because there is a ratchet and click at one end of the roller which prevents it; the rope, therefore, slips round upon the roller. When the carriage retires, the great weight turns the roller and endless cloth round, so as to deliver out the cardings at the same rate as the carriage retreats and takes them up; but when the proper quantity is given out, the knot in the rope arrives at a fixed stop, which does not permit it to move any farther; and at the same instant the roller 5 quits the lever 6, and allows the upper rail G of the clasp to fall, and hold the carding fast from being drawn out any farther; the wheel E is then put in motion to turn the spindles round, and the carriage is drawn back, which extends the slubbings, and twists them at the same time, as before mentioned.

When the carriage is drawn out to its full extent, and the necessary twist is given, the wire 8 is put down to bear down the slubbing from the point of the spindle, and the motion of the wheel being continued, the slubbings are wound up upon the middle part of the cop or ball which is formed upon the spindle; but as fast as the slubbings are wound up, the spinner must push back the carriage towards the clasp; and he must turn the wheel round at such a rate that the

spindles will not wind up any faster than the carriage returns, otherwise the slubbings would be broken or unequally stretched; he must also raise and lower the wire 8 continually, by turning the rail 4 round in his hand, in order to distribute the slubbing on the cop in a regular manner, so as to make a firm ball or cop.

A child attends the machine to bring the cardings from the carding-machine, and place them upon the inclined cloth; and when they are exhausted, fresh ones are joined on, so as to keep the machine constantly supplied.

The degree of twist which is given to the slubbing is regulated by the discretion of the spinner in turning the wheel at a proper rate, corresponding to the quickness with which he draws out the carriage. Slubbings which are intended to be spun into yarn for the warp of the cloth require to be more twisted than the slubbings intended for the weft; but the proper quantity of twist depends on the fineness of the wool, and the length of its fibres. In general it may be stated, that no more twist is given to the slubbings than is necessary to make them draw out to the required extent without breaking. This twist is of no use to the yarn, because the slubbing will be twisted in the contrary direction, when it is spun the second time in the jenny.

An improved slubbing-machine has been introduced, which is put in motion by the mill, and the carriage is made to draw out by the power of the machine. The spinner has only to push the carriage in, and turn the handle, in order to wind up the slubbings; by this means, a greater degree of regularity is attained in the quantity of twist which is given to the slubbings when they are drawn out. The movements to effect this are taken from the mule used in cotton-spinning. See *Manufacture of COTTON*.

Spinning Jenny.—In this machine, the slubbings are spun over again, and reduced to the requisite fineness for weaving. The jenny has nearly the same parts as the billy, but differently arranged. The spindles are placed at one end of the frame, and the clasp which holds the slubbings is placed on the carriage, so that it can be moved backwards and forwards, to and from the spindles by the spinner, in order to draw out and extend the yarn at the same time it is twisted.

A perspective view of the jenny is given in *Plate II. Woollen Manufacture*.

The spindles 3, 3, 3, are placed perpendicularly at about four inches asunder at one end of the frame AA of the machine. The lower extremities of the spindles are pointed, and turn in small cups or sockets in a cross-rail of the frame; they are supported near the middle of their length by passing through brass-collars in a horizontal rail. Near the lower end of each spindle a small pulley is fixed, to receive an endless band, which passes round the horizontal cylinder or roller 2, about six inches diameter. The cylinder is supported on pivots at its ends in the sides of the frame, and lying in a direction parallel to the row of spindles, it turns them all round by a small band for each. This cylinder is usually made of tin-plate, that it may not alter its figure by the weather, as wood would do; and its surface is covered with coarse brown paper, to prevent the bands from slipping upon it. The cylinder 2 is put in motion by a strap or band 1, 1, which passes round a pulley at the end of it, and also round the great wheel BB, which is supported in a framing suspended over the machine from the ceiling, but which is not shewn in the drawing. The wheel B is turned by applying the right-hand to the winch B. In front of the row of spindles, and about a foot higher than their points, a long cross-rail 16 is situated horizontally: it is supported at each extremity by being mortised into blocks of wood *c c*, which are furnished

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with small wheels or gasters, forming a sort of carriage, to run horizontally upon the side-beams of the main-frame in grooves, which guide them, so that the rail 16 can be moved backwards and forwards through a space of about six or seven feet, in a horizontal position, without varying from its parallelism with the row of spindles. The underside of the rail 16 is formed into a number of narrow notches for the slubbings to pass through; and these notches are partly filled up by projecting pieces, rising up from a second cross-rail 5, 5, so as to form the clasp which confines or pinches the slubbings in the notches when the lower rail is raised up; but the slubbings can draw freely through the notches when the lower rail is let down. This lower rail is guided and limited to move up and down only a small space by staples, which project downwards from the rail 16, and receive the ends of the lower rail 5 of the clasp. The rising and falling of the lower rail is effected by small cords fastened to it at about every yard of its length; these cords are conducted over small pulleys (concealed in the substance of the upper rail 16), and are all attached to a handle, situated over the middle of the upper rail at 16, and beneath an arched bar, which is fixed on the top of the clasp. The spinner holds this handle in the left-hand, whilst the right is employed in turning the wheel; and by the fingers of the left-hand she can raise up the lower rail 5 of the clasp, and draw it close to the upper one. It will then be retained in that position by a small spring-catch, and will clasp the slubbings fast in the notches, through which they pass; but when the spring-catch is pushed back, so as to relieve the handle, the lower rail will fall down by its own weight, and release the slubbings, to allow them to slide through the notches.

The cops of slubbings which are to be spun are supported in an inclined frame 4, 4, fastened within the main frame of the machine. The cops are mounted upon iron wires; they are placed in two rows, one above the other, as shewn in the drawing; but each row should only contain half as many cops as there are spindles.

Each slubbing is conducted through a notch in the clasp, and thence it proceeds nearly in an horizontal position to the spindles 3, 3.

When the yarns have been drawn out and twined they are wound up on the spindles in balls, in a similar manner to the billy. The wire which is used for bearing down the thread from the points of the spindles is marked 12; it is attached to a horizontal rail, which is supported on pivots at its ends, close to the row of spindles. There is a small pulley 11, fixed at one end of the rail, and a short lever at the other, which lever is hidden in the drawing by a part of the framing. Between the pulley 11 and the lever, the wire 12 is extended, and by turning the rail round upon its pivots, the wire will have a motion up or down.

The spinner can communicate motion to the pulley 11 by means of a cord 7, 7, which passes round it, and extends the whole length of the frame, the end being made fast to a pin at A; this cord lies over the surface of one of the blocks c, which contains the wheels of the carriage, and passes between three small pulleys 9, 6, and 8. The centre pins of the pulleys 9 and 8 are fixed to the block; but the centre pin of the pulley 6 is fixed to a small slider, and can be drawn in the direction of the rail 16, by applying the finger to a small trigger near the handle 16. This action removes the pulley 6 out of the line of the other two pulleys, so as to shorten the cord 7, and turn round the pulley 11; this brings down the wire 12, and bears down the threads upon the spindles. A small counterweight is suspended from the wheel 11, to return the wire to its former position when the pressure of the finger on the trigger is removed. By

this movement, the spinner has full command of the wire 12, to raise or lower it in any degree she thinks proper; and this is done independently of the motion of the carriage, because the pulleys 9, 6, and 8, run freely along the cord 7, and their motion has no tendency to move the wheel 11 either way.

The jenny is worked by one person, who stands within the frame, and turns the wheel B with the right-hand, whilst he holds the clasp in the left, so as to run it backwards and forwards along the frame at pleasure. The slubbings are drawn between the moveable rails 16 and 5, in the notches of the clasp, and each slubbing is fastened on to its corresponding spindle. The clasp being left open is drawn backwards from the spindles, and the slubbings run freely through the notches of the clasp; the slubbings are drawn off the balls at 4, when the clasp retires from the spindles, until a certain length of each slubbing is drawn out and extended nearly in an horizontal position between the spindles and the clasp: this length is regulated by a mark made on the frame of the machine, to indicate when the clasp has arrived at its proper position. The bars of the clasp are then brought together by raising up the handle under the catch, as before described, and it fastens all the slubbings in the notches. This being done, the spindles are put in rapid motion by turning round the large wheel B B; they twist those parts of the slubbings which are extended, and the motion being in a contrary direction to the twist of the slubbing, the first tendency is to untwist the slubbing, at the same time that the carriage and clasp are gently drawn back, or from the spindles. By this means, the slubbings are stretched or drawn out in length at the same time that they get a new twist in the opposite direction; this keeps them from breaking, and when they are drawn to their intended extent by the carriage being moved back to the stops at the extremity of the main frame, the great wheel is turned round as many turns as is necessary to give them all the twist which those portions of thread are intended to have.

The threads extended between the clasp and the spindles are now finished, and it only remains to wind them up upon the spindles, previously to drawing out a fresh portion of each slubbing, in order to spin it in the same manner. To wind up the threads, they are pushed down upon their respective spindles, by pressing the trigger which moves the wire 12; and the motion of the great wheel B is continued, in order to wind up the slubbings in balls upon the spindles, at the same time that the carriage and clasp are pushed back towards the spindles. When the carriage is got home, the thread is finished and wound up, and a fresh portion of slubbing is extended. To do this, the lower rail of the clasp is dropped down, and it releases the slubbings; the carriage is then drawn back to the mark upon the frame, as before described, which shews that a proper length of each slubbing is drawn off from the balls, and extended between the spindles and the clasp. The clasp is then closed, and the wheel B put in motion to twist the threads whilst the carriage is drawn out; thus the spinning operation is repeated as before, and prepares another length of each of the threads. When finished, they are pushed down from the points of the spindles, in order to make them wind up thereon in the balls, as before.

There is some discretion required in spinning with the jenny, to draw out the carriage with a movement correspondent to the rapidity with which the spindles give the twist, or rather untwist, to the slubbing; for the principal extension of the thread is effected whilst the slubbing is untwisting, and whilst the first portion of twist is given to the threads. These motions must be properly proportioned by

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the spinner, who must also be careful to give an equal degree of twist to each successive portion of thread which is spun, otherwise the thread will consist of hard and soft places.

When the yarn is intended for the warp of the cloth, the spindles are turned for a given time after the thread is extended to its full length, as we have before mentioned; but for the yarn which is to be used as weft, it is different: the whole of the twist is given during the extension of the thread, and none afterwards; this difference is to render the weft softer than the warp, because in the cloth the weft appears more on the surfaces than the warp, and it is principally the felting and interlacing of the fibres of the weft that will form the surface of the cloth when finished.

The yarns are usually extended in the jenny two and a half or three times the length of the slubbings from which they are spun; and that degree of twist given to them which is suitable to the purpose for which the yarn is to be employed.

The *Mule for spinning of Yarn* is very nearly the same machine as the mule for spinning cotton; this is used for spinning some kinds of woollen yarn instead of the jenny. When the mule is employed for spinning yarn for weft, it is used in the same manner as described in our article *COTTON MANUFACTURE*; but for spinning warp, the spindles are made to revolve, and twist the thread some time after the carriage is run completely out, and the stretching of the yarn is finished. There is a movement in the machine that shifts the endless strap which turns the mule upon a larger pulley, as soon as the carriage is run fully out, so as to give a more rapid motion to the spindles after the stretching, or drawing out, is finished, than they had during the drawing back of the carriage. By this means some time is saved, because the spindles may be allowed to run very quick when it is only required to twist the threads; but whilst the extension is going on, the twisting motion must be moderate, or the threads would be broken. A very similar movement is used in the mule for spinning cotton, and is called the double-speed; but the description of this mechanism is omitted in the article *MANUFACTURE*.

The mule has not, till lately, been in much repute for spinning woollen yarn, and the jenny is still thought to spin better yarn: but we have no doubt that when certain modifications are made, it will become a much more perfect method than the jenny, being much less dependent on the discretion and dexterity of the spinner; for if the machine is once constructed so as to spin properly, it will always continue to do so.

To keep the yarn to the size which is intended, a few of the coppins are reeled off, in order to measure out a certain length of the yarn, which is weighed; and if it does not prove of the weight expected, the quantity of wool which is spread over a given surface of the feeding-cloth of the carding-machine must be increased or diminished accordingly; and when the right quantity is formed, the lead weights which are used for weighing the given quantity of wool are altered to suit it. The draft of the jenny may also be altered to effect the same thing.

The spinning processes are now finished, and it remains to weave the yarns into cloth. From the description we have given, it will appear that woollen yarn is spun in a very different manner from cotton. The opening processes and the scribbling and carding are very similar, except that the carded wool, instead of being drawn into a continued sliver like cotton, with the fibres stretched the lengthways of the sliver, is formed into separate rolls, with the fibres disposed crosswise or spirally round the roll.

By the slubbing-machine these are joined together, drawn

out in length, and slightly twisted, by operations similar to that of roving in cotton-spinning; but the operation of drawing, which is so frequently repeated for cotton, would be useless, and to a certain extent even prejudicial for wool. The object of that process is to elongate and stretch the fibres of the cotton straight, and lay them parallel to each other; but it does not reduce the sliver to a smaller size, because as many times as the sliver is extended in length, so many slivers are put together into the drawing-frame at once, leaving the sliver which has been drawn the same size as it was before, but elongated to three or four times the length, and all its fibres fully extended.

As woollen cloth is intended for felting, it is not desirable to straighten the fibres, but only to disentangle all knots, and unfold any fibres which may be doubled, also to lay the fibres in the direction of the length of the thread. There is a natural curl in the fibres of wool which should be preserved, and will contribute to the firmness with which the fibres will entangle in the felting.

The operation of spinning by the jenny and billy are very similar, but both differ from the manner in which the extension is made in the cotton spinning-machines by rollers. In the jenny, the extension is made upon a considerable length of the carding or slubbing at once; but in the rollers, the length of cotton which is submitted to the action of drawing out is very short, indeed very little longer than the length of the fibres of the cotton. In mule spinning both modes of extension are practised; first, drawing the roving by rollers, and then a certain length is stretched out to a greater extent.

Warping.—The coppins of yarn are mounted on wires in a frame, and the yarns are drawn off from them, in order to combine a sufficient number of them together, to form the warp for the web of cloth which it is intended to weave. For instance, for making the cloth called double drab, which we shall take as an example, 2960 threads, each 65 yards long, are laid parallel to each other; but a separation is preserved at every 40 threads, dividing the whole into 74 parcels, for the convenience of the weaver.

The warping is performed by the warping-mill, which is a large reel, with its axis horizontal; the ends of the threads are made fast to the reel, which is turned round, and it draws the threads off the coppins, so as to wind them upon its circumference; and to prevent the different turns of the threads from lying one over another, the threads are guided through an eye or ring affixed to a slider, which is moved along a wooden rail, in a direction parallel to the axis of the reel, by a cord that winds round one end of the axis of the reel.

A warping-mill for silks is described in our article *SILK*, and will give a clear idea of the present, which only differs in the horizontal position of the axis, and in the greatness of its dimensions. The threads for the warp being thus assembled together, are taken off the reel, and rolled up into a bundle.

The warp is then scoured in urine, to remove the greasiness of the wool, and is next sized; to do this, it is dipped into the cauldron of size, about ten yards in length at a time, and well worked in by the hands. After sizing, the yarns are stretched out at length in a field, till they are dry, and the warp is then ready for the loom.

The yarn for the weft is wound off from the cops of the jenny to the quills or small bobbins, which are to be put into the shuttle.

The loom for weaving broad-cloth has the same parts as the simple loom described in our article *WEAVING*; but it is made very strong, to enable it to resist the strain of weaving

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such broad and heavy cloth. The fly-shuttle, invented by John Kay in 1737, is now in general use; it enables one weaver to do the work, which formerly employed two men at opposite sides of the piece, to throw the shuttle from one to the other, the width being greater than a man can reach. The warp is wound on the yarn-beam, which is placed in the loom, and the threads being drawn through the heddles and the reed, and fastened to the cloth-beam, the loom is ready for working, in the usual manner of weaving plain cloth. At each edge of the warp a few threads of strong and coarse yarn are placed; these form what are called the lifts when the cloth is woven, and serve to give strength to the cloth, and receive the hooks by which the piece is stretched in the tenters after milling.

The width of the cloth is measured between the lifts and the number of yarns, which we have specified will make 100 inches in width for the double drab-cloth, or for common cloth 3000 threads will make a piece $103\frac{1}{2}$ inches wide. The quantity of weft used for these cloths is upon an average one pound weight to a yard in length. The length of the warp contracts a little in the weaving, so that the sixty-five yards of yarns will make only sixty-two yards of cloth.

Scouring.—The piece of cloth must be cleaned from the greasiness of the oil before it can be felted; for this purpose, it is first soaked three hours in a mixture of urine and pig's dung, it is then scoured in the mill for two hours, and lastly, for half an hour with fair water. The scouring is performed at the fulling-mill by a pair of stocks. (See *FULLING-Mill*.) The pair of stocks are two large wooden hammers, suspended with the helms or handles in an inclined position, and the heads are lifted in succession by cogs or tappets, fixed on the axis of a water-wheel. When the cogs quit the hammers, they fall by their own weight, and strike the piece of cloth, which is contained in a wooden cistern or trough, in which the hammers work. The action of the hammers is to beat and compress the folds of cloth, and to turn the piece continually round in the trough or cistern in which it is placed. The form of the trough is such, that the weight of the piece of cloth causes it to occupy the lower part of the trough, and each hammer when it descends drives the cloth out from this lowest part, and forces it up a curved sweep. When the hammer is lifted up, the cloth falls again into the space which it before occupied, and at the subsequent descent of the hammer it is again driven out; the heap of cloth is of a considerable bulk, and this action of the hammers is chiefly on the lower part of the heap; the beaks of the hammers strike nearly horizontally under it, as it were to undermine the heap, so that the top part falls over when the hammers retreat. This action causes a continual circulation or turning round of the piece of cloth within the trough, and effects the scouring, by continually bending and folding the cloth in a fresh direction; and as the strokes act upon a great number of folds at once, the different surfaces of the cloth are caused to rub against each other, with a very similar action to washing cloth by hand.

When the scouring is finished, the piece of cloth is taken out, and extended in a vertical plane, in a frame called the tenter, where it remains till dry.

The *tenter* consists of a number of vertical posts fixed in the ground with a continued horizontal rail, which is fixed on the top of them, and is as long as the piece of cloth; there is also another line of horizontal rails, which are fitted between the upright posts, so as to slide freely up and down; and they can be fixed at any distance beneath the upper rails by means of pins in the posts, according to the width of the piece of cloth. Both the upper and lower horizon-

tal rails are driven full of tenter-hooks, which are small iron rails sharpened at both ends, and bent at right angles, like an L; on these hooks the lifts of the cloth are fastened, and the lower or moveable rails are fixed at the proper distance beneath the upper rails, in order to extend the cloth to its full width.

Burling.—The cloth being dried is burlled, that is, examined minutely in every part, and all knots and uneven threads or straws, or extraneous matters, removed; any rents or defects which can be found are repaired, by introducing fresh threads. This being done before the milling or felting, the fibres of the new threads will become so entangled as to render such defects nearly imperceptible in the finished cloth.

Fulling-Mill for felting the Cloth.—There is another kind of stocks in a fulling-mill; but the shape of the trough in which the stocks or hammers work on the cloth is different from that described in the article *FULLING-Mill*, which is only proper for scouring. In order to subject the cloth to the blows of the hammers, the trough for milling is formed in such a manner that the cloth cannot escape from them, because that part of the trough which is opposed to the beaks of the hammers is nearly a flat surface, and perpendicular to the direction in which the hammers strike, so that the cloth is actually beaten between the beaks of the hammers and the flat bottom or rather side of the trough.

The hammers are made to strike very heavy blows; but they do not bruise or injure the cloth, because there is always a great number of folds of cloth on which they strike. The helms or handles of the hammers are placed in a different position from the scouring-stocks, in order to make the hammer-heads fall in a more perpendicular direction when they make their stroke, and hence they strike with more force. On this account they are called falling-stocks, whilst those used for scouring are called hanging-stocks, in which the helms of the hammers being nearer to the perpendicular, the heads move in a more horizontal direction, in the manner of a pendulum, and exert less force on the cloth; the other difference is, that the hammers of the scouring-stocks only drive the heap of cloth round in the trough, there being no part directly opposed to the beaks of the hammers but a fair curve, which is so much inclined to the direction in which the hammers move, that the cloth mounts up the inclined curve when the hammer strikes, and evades the direct force of the blow.

There is another kind of fulling-stocks, in which the trough and hammer are constructed with a view to mill or felt the cloth; but the hammers are put in motion in a different manner: thus the helms are suspended in a vertical position, like pendulums, and the force of the cogs on the horizontal shaft, which is turned by the water-wheel, is applied to drive the hammers forwards against the cloth, and produce the felting. To return or draw back the hammers, a chain is attached to each, and these chains are linked to the opposite ends of an horizontal lever, like a scale-beam, which is fixed in front of the stocks. This lever and chains draw back one hammer when the other is pushed forwards; and as the hammers are actuated alternately by the cogs, a constant action is kept up.

The most simple fulling-mill by a water-wheel has no other wheels, but the tappets or cogs which lift the hammers are fixed immediately into the axis of the water-wheel, and it usually gives motion to two pair, one at each side of the wheel. It rarely happens that this construction of a mill allows the water to be used to the greatest advantage, because the circumference of a water-wheel should not move with a greater velocity than between 180 and 240 feet *per* minute;

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minute; and the hammers of a fulling-mill should be so timed, that each one will make from about 30 to 36 blows *per* minute. This requires that the cogs for the hammers should be numerous, and fixed in the circumference of a large wheel fixed on the axis of the water-wheel, otherwise the water-wheel must be made to turn so quickly as to lose a great part of its force. A better way is to apply a cog-wheel on the axis of the water-wheel to turn a pinion on the horizontal shaft, which carries the cogs for the hammers, and this horizontal shaft may have a fly-wheel upon it, to regulate the motion and render it uniform.

Mr. Smeaton's proportions for a fulling-mill for two pair of stocks were as follows:—The water-wheel, 14 feet diameter, 7 feet broad; it was a breast-wheel, and the fall of the water was five feet from the surface of the mill-pond to the tail-water below. The spur-wheel on the axis of the water-wheel 72 cogs, and $9\frac{1}{2}$ feet diameter; the lantern turned by it 23 rounds. Upon the same shaft as this lantern was a fly-wheel of eight feet diameter, with a rim of cast-iron seven inches square, and also the two cogs or tappets for each of the four hammers forming two pair of stocks. The same mill was adapted to be turned by the power of horses in dry seasons; for this purpose, another lantern of 13 teeth was applied on the other end of the same horizontal axis, which could be occasionally turned by a horizontal cog-wheel of 90 teeth and 12 feet diameter, fixed on the vertical shaft, which the horses turned. The levers by which the horses drew were 15 feet long, so that the horses' track was 30 feet diameter.

It required four horses to work one pair of stocks in this mill, and when Mr. Smeaton tried the expenditure of water at this mill, and also at another mill with an overshot-wheel, he found it required from 1200 to 1400 cubic feet of water *per* minute, falling one foot, to work a pair of stocks. Taking the force of a horse at 352 cubic feet *per* minute raised one foot, this is very nearly equal to four horses. These stocks were used for fulling of bays, and we apprehend the power for working the fulling-mills for broad-cloth is greater.

Process of Milling.—A piece of cloth of sixty-two yards long has six pounds of soap allowed for it, which is dissolved in water, and a handful spread upon every yard in length; the piece is then put into the trough of the mill, and worked for three hours; during this time the cloth is frequently moved in the trough, to expose fresh surfaces to the action of the hammers. The blows upon the cloth cause a motion of the fibres of the wool amongst one another, and the soap facilitates this motion; the fibres of the wool have the singular property of moving always forwards in the direction of the roots of the hairs, when a number of hairs are rubbed or worked together, but they will not retreat in the opposite direction; this produces the matting or entangling of all the fibres together. After three hours milling, the piece of cloth is taken out of the trough, and soaped again, then returned and milled again for three hours. This is repeated four times, making twelve hours milling in the whole, and then a stream of fair water is admitted into the trough, to wash away the soap. The piece of cloth, when taken out of the mill the last time, is generally found reduced to about 60 inches broad, and 40 yards in length; before the operation, it was 100 inches broad, and 62 yards in length.

The operation of felting is so well explained by M. Monge, in the *Annales de Chimie*, that we think proper to give an extract from his memoir, in addition to what is stated in our articles FELTING, FULLING, and WOOL.

If we examine a human hair, a fibre of wool, or the hair of a rabbit, hare, beaver, &c. in a microscope of the greatest

magnifying power, the surface of each hair appears smooth and even; or at least if any inequalities are perceptible, they seem rather to arise from some difference in the colour and transparency of particular parts of the fibres than from the irregularity of their surfaces; for their images, when viewed by a solar microscope, are terminated by even lines, without any roughness. Nevertheless it is probable the surfaces of these objects are formed either of *laminae*, which cover each other from the root to the point, much in the same manner as the scales of a fish cover the animal from the head to the tail; or still more probably of zones placed one over the other, like what is observed in the structure of horns; to this conformation it is, that such substances owe their disposition to what is called felting.

If with one hand we take hold of a hair by the roots, and draw it between two fingers of the other from the root towards the point, we are hardly sensible of any friction or resistance, nor can we distinguish any sound; but if, on the contrary, we draw it between the fingers from the point towards the root, we are sensible of a resistance which did not exist in the former case. A sort of tremulous motion is also produced, which is not only perceptible to the touch, but may also be distinguished by the ear.

It is evident, therefore, that the texture of the surface of a hair is not the same from the root towards the point, as from the point towards the root. As this texture is the principal object of the present memoir, it is necessary to demonstrate it by some other observations.

If a hair is held between the fore-finger and thumb, and rubbed by them backwards and forwards alternately in the direction of its length, a progressive motion of the hair will take place; but this motion is always with the root forwards, although the rubbing of the finger and thumb is alternately in both directions. This effect does not at all depend on the nature of the skin of the fingers, or its texture; for if the hair be turned, so that the point is placed where the root was, the movement then becomes contrary, *viz.* its motion is always directed towards the root.

What is observed in the above instance is entirely analogous to what happens when country children, by way of sport, introduce an ear of rye between the wrist and the shirt-sleeve; the points of the beards of the ear are directed outwards, and by the various motions of the arm, this ear, sometimes catching against the shirt, sometimes against the skin, takes a progressive motion backwards, but the beards always resist its return, so that it soon gets up to the arm-pit. It is very clear, that this effect is produced by the asperities upon these beards, which being all directed towards the point, do not permit the ear to move in any other direction than towards that part which was united to the stalk. There can be no doubt that it is the same with respect to hair, and that its surface is beset with asperities, which being laid one upon the other and turned towards the point resist all motion, except towards the root.

These observations, which it would be useless to multiply, relate to long hair, which have been taken as examples; but they apply with equal propriety to wool, furs, and in general to every kind of animal hair. The surface of all these is, therefore, to be considered as composed of hard *lamellae* placed one upon another, like tiles, from the root to the point; which *lamellae* allow the progressive motion of the hair towards the root, but prevent a similar motion towards the point.

From what has been said, it will be easy to explain why the contact of woollen stuffs is rough to the skin, while that of cotton or linen cloths is smooth: the reason is, that notwithstanding the flexibility of each particular fibre, the asperities

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perities upon the surface of the fibres of the wool, by fixing themselves in the skin, produce a disagreeable sensation, at least till we are accustomed to it; whereas the surface of the fibres of hemp or flax, of which linen is made, being perfectly smooth, do not cause any such sensation. It is also probable, that the injury arising to wounds or sores from the application of wool does not proceed so much from any chemical properties, but is occasioned solely by the form of the surface of the fibres, the asperities of which attach themselves to the raw and exposed flesh, which they stimulate and irritate to such a degree as to produce inflammation.

The asperities with which the surface of wool is every where surrounded, and the disposition which it has to assume a progressive motion towards the root, renders the spinning of wool and making it into cloth difficult operations. In order to spin wool and afterwards to weave it, we are obliged to cover its fibres with a coating of oil, which, filling up the cavities, renders the asperities less sensible; in the same way as oil, when rubbed upon the surface of a very fine file, renders it still less rough.

When a piece of cloth is finished it must be cleaned from this oil, which, besides giving it a disagreeable smell, would cause it to soil whatever it came in contact with, and would prevent its taking the colour which is intended to be given to it by the dyer. To deprive it of the oil it is scoured at the fulling-mill, by working it with hammers in a trough full of water or urine, in which fuller's-earth is sometimes mixed. This earth combines with the oil which it separates from the cloth, and both together are washed away by the fresh water, which is afterwards brought to it in the machine. Thus after a certain time the oil is entirely washed out of the cloth.

The fulling, which succeeds the scouring of the cloth, is aided by the application of the soap. The alternate pressure given by the hammers to the piece of cloth, especially when the milling is pretty far advanced, occasions an effect analogous to that which is produced upon hats by the hands of the hatter; the fibres of wool which compose one of the threads, whether of the warp or the weft, assume a progressive movement with their roots forwards, and introduce themselves among the fibres of the threads nearest to them, then into those which follow; and thus by degrees all the threads, both of the warp and the weft, become felted together. The cloth, having by the above means become shortened in all its dimensions, and thickened in its substance, partakes both of the nature of cloth and of that of felt; for at the same time that the threads give it considerable strength, it may be cut without being subject to ravel, and on that account we are not obliged to hem the edges of the pieces of which wearing apparel is made. Lastly, as the threads of the warp and those of the weft are no longer so distinct and separated from each other as to leave interfaces between them, the cloth forms a warmer clothing, independently of its having acquired a greater degree of thickness. Knit worsted is also rendered less apt to run, in case a stitch should drop, by the operation of fulling.

Tentering.—When the milling is finished, the cloth is stretched again on the tenter. It is usual to extend the piece to forty-two yards in length, but not at all in breadth; indeed only one inch of extension in each yard is allowed by law. The cloth remains in the open air until it is perfectly dry and ready for the succeeding operations of finishing, which are only intended to give it a beautiful surface, for it already possesses all the useful qualities of cloth.

Dressing the Cloth with Teafels.—This operation is to raise up the nap or loose fibres on the surface of the cloth, by

scratching it over with a species of thistles called teafels, in order to form a wool on the surface, which can be removed by shearing. The teafels are the balls or ears which contain the seed of the plant called *dipsacus fullonum*; the scales which form the ball project on all sides, and are terminated with sharp points, which turn downwards, like hooks, and are very elastic. See TEASEL.

A number of teafels are put into a small frame, which is composed of a handle eight or ten inches long, having a small stick passed through it at one end about eight inches long, which is split into two at each end nearly all its length. There is also another similar stick, which is passed through the handle near the middle of its length; the two split sticks are perpendicular to the stem or handle, and parallel to each other. The space between them is filled with teafels, which are jammed in very fast between them, and also in the clefts of the split sticks, where they are secured by strings extended between the ends of the split sticks, and twisted, until they draw the sticks forcibly together, and bind the teafels very fast. This frame filled with teafels forms a tool, which very much resembles the curry-comb used to clean horses, and is used in a similar manner, to scratch over the whole surface of the cloth, and draw out all loose ends of the fibres of the wool, which are not firmly confined by the entanglement of the felting.

The dressing is performed by two men, who hold the teafel-frame by its handle, and work the cloth, when it is hung up in a vertical position over two rails fixed to the ceiling; when they have worked over as much surface as they can reach, they draw down a fresh portion, which they work in turn, and thus proceed until they have finished the whole piece. The first time the cloth is dressed it is wetted with water; it is worked three times over in the wet state, by strokes in the direction of the length of the piece, and then it is worked again three times in the other direction; by this means all the fibres are raised, and the cloth is prepared for shearing.

In the most improved manufactories, the dressing is performed by the gig or gig-mill. This is a cylinder covered on its surface with teafels, and turned rapidly round whilst the cloth is drawn over it.

The *Gig-mill* is represented in perspective in *Plate V. Woollen Manufacture*. M is the wood frame of the machine; FF is the cylinder or drum, which is composed of 12 rails or troughs, filled with teafels FF, 3, 4, &c. These are fastened on the circumference of two or three wheels fixed upon a wooden axis 7; the drum is put in motion by a pulley ED at one end of its axis, which receives an endless strap, 2, from the drum C, situated above the machine. There are two pulleys, E and D, one fixed fast on the axis, and the other fitted on loosely, with liberty to turn round freely upon it; the strap can be shifted to either pulley, and accordingly the machine will be put in motion, or will stand still.

The drum C is fixed on one end of an iron shaft 1, which is put in motion by a bevelled wheel B, from the larger wheel A, fixed on the great horizontal shaft, which proceeds the whole length of the mill. The drum, FF, covered with teafels, is mounted on bearings supported by the frame, and the piece of cloth G is conducted over it, to receive the action of the teafels; one end of the piece of cloth is wound round a roller J, and the other end of the piece is wound on the roller L; both these rollers are put in motion from a bevelled wheel 6, fixed on the extremity of the axis of the drum; this turns a wheel H upon an inclined axis, which has a pinion at each end; one of these pinions, 9, turns a bevelled wheel, K, on the end of the axle of the upper roller

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roller L; and the other, 8, turns the wheel I belonging to the lower roller J. By means of this wheel-work both rollers are turned round in the proper direction, to make the upper roller L wind up or draw the cloth, whilst the lower roller unwinds and gives out the cloth. N is a pipe, which conveys water to the machine; it is pierced with a number of holes to throw jets of water on the cloth, and wet it.

As fast as the cloth is taken up by the roller L, it is given out by the other roller J, and is then drawn over the surface of the cylinder, as at G, the teasels of which, as it revolves, act very effectually on the cloth to raise the nap. When the whole piece has passed, and is gathered up on the roller L, the machine is stopped, by shifting the strap 2 to the loose pulley D, then the two rollers L and J are exchanged, and the operation is repeated as before, and so on till the nap is sufficiently raised.

The mode of repeating the action on the cloth by exchanging the rollers is troublesome, and a better mode is to provide the means of disengaging either of the wheels K or I from its respective pinion, making the machine so that only one wheel and pinion can be engaged at once; also to make the motions in such direction that the roller which is engaged shall always wind up the cloth upon itself. Each roller must have a small wheel upon one end of it, as shewn at 10, with a lever and weight 11, to press upon the circumference of the wheel with such force as to occasion a friction, and make the cloth draw tight when it is drawn off the roller. In this way, the cloth can be made to work either backwards or forwards; because that roller which is engaged with the wheel-work will wind up the cloth, and draw it off from the other roller across the drum; but when all the cloth is wound off, that roller which has taken the cloth must be disengaged, and the other put in action, which will make the cloth work back again.

The most improved gig-mills used in Yorkshire have a still better method of moving the cloth. This is by means of a pair of rollers in the place of the upper roller L: they are turned round by a large spur-wheel on the end of the roller, which works in a smaller wheel on the end of the drum; one roller is mounted over the other, like the two rollers of a flattening-mill, and pressed together by screws with sufficient force to draw the cloth between them. The piece of cloth, when brought to the machine, is laid down on a board on the ground before the machine, and one end is passed under the roller J, which is merely to guide it; then it is carried over the drum, as at G, and introduced between the pair of rollers at L, which draw it slowly forwards; from these the cloth turns upwards, and is extended horizontally over two rollers which are suspended from the ceiling. After quitting these rollers, it descends perpendicularly, and is gathered on the ground in folds on a board or bench, close to the place where the piece of cloth was laid before the dressing was begun. In order to make the piece of cloth pass a second time through the machine, or as many times as is required, the two ends of it are sewed together, so that it circulates continually over the drum without any interruption or trouble: it is usually done three or four times.

It is an advantage of this method, that the cloth, in descending from the ceiling, hangs perpendicularly, and with that side which has been dressed opposite to the light, so that the workman who gathers it in folds can examine the progress of the work; and when he judges that the cloth is sufficiently dressed, he cuts the sewing which unites the two ends together, and then the end of the piece comes out of the machine, and the cloth is carried away to give place to another piece.

The drum or cylinder of the gig-mill is composed of a number of shallow troughs, fixed on the circumference of the wheels of the drum, and parallel to its axis: into these troughs, frames filled with teasels, like those we have before described, are fastened in a very simple manner; and the frames are placed so close together, that the trough is wholly filled, and forms a continuous surface of teasels to act upon the cloth when the cylinder revolves. When the hooks of the teasels become filled with flocks or fibres of wool, which they have drawn out from the cloth, they are removed from the cylinder, in order to be cleaned by children, who pick out the flocks with a small steel comb.

The teasels are cultivated very largely in the clothing countries; but it sometimes happens, in particular seasons, that the crops fail, and they are then very dear. This has produced many trials of metallic teeth as substitutes for teasels. Mr. Price of Stroud, in Gloucestershire, has two patents, dated 1807 and 1817, for this object; Mr. Laffalle of Bristol took a patent in 1816, Mr. Williams of Furdley in 1817, and Messrs. Lewis of Brinscomb in 1817. We are not informed if any of these inventions are yet brought into real use in the manufacturing district.

Shearing or Cropping the Cloth.—By the operation of the teasels, the wool is become raised all over the surface of the cloth in a loose fur, which must be removed by shearing before the cloth will be fit for wearing, because the fur would gather dirt and dust, and would wear very unequally.

The shears used for cropping by hand are the same as those used in the common shearing-machine, and are represented at E, E, in *Plate III. Woollen Manufacture*. The clothier's shears consist of two very large flat blades of steel, united together by a stem of steel, which is bent into a circular bow, and is sufficiently flexible to allow one of the blades to be moved upon the other, in order to make them cut. Both blades are ground to sharp and straight edges, which apply one to the other, but the blades are not in parallel planes like scissars, for one of the blades is laid quite flat upon the cloth, and the plane of the other blade will then be inclined to the cloth at about an angle of 45 degrees, as is shewn in *Plate III*. The cutting-edge of this inclined blade bears upon the surface of the flat blade, and the spring of the bow is so set, as to press the two edges always in contact. The lines of the edges of the two blades are not parallel to each other, but inclined, so that the edge of the upper blade crosses the edge of the lower blade, and bears upon the flat surface of that blade, at the end nearest to the bow, whilst the other end of the edge of the upper blade is removed over the edge of the lower blade, thus leaving an interval between the two edges, when the shears are open, as is plainly shewn in the figure. In this state, the shears being open, if the lower blade is laid flat upon the surface of the cloth, the nap or wool, which is to be removed by the cropping, will stand up above the edge of the lower blade, in the interval between the two edges; then if the blades be forced together, the edge of the upper blade will pass or cross over that of the lower, and cut away all the wool which projects above the edge of the lower blade. The contact of the cutting-edges begins at the end nearest to the bow, and proceeds regularly to the other, because, as before mentioned, the edges are not parallel to each other. The blades open or return to their former position by the elasticity of the bow, but in order to make the cut they are closed by means of a handle or lever 10, which is fitted or lodged on a round part of the stem of the bow, so as to play thereupon as upon a centre of motion. A double cord is made fast to the lever or handle near to this centre, and the

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the other end of the cord is fastened to a block of wood, which is screwed to the flat of the lower blade, and rises up to a proper height. By depressing this handle, the shears are closed, and make their cut with the greatest facility, the elasticity of the bow returning the handle.

The manner of cropping with these shears is as follows:— The piece of cloth is laid down in folds upon a plank or low bench placed on the ground, and the end is drawn across a table or bench, which is covered with cloth, and stuffed with horse-hair, like a cushion. The cloth is stretched out flat upon the surface of the table, and is retained by hooks and weights. Two workmen are employed to shear a piece of cloth; they place the lower blades of their shears flat on the surface of the cloth, with the line of the edge in the direction of the length of the piece; one of the shears is laid on the edge or lift of the cloth, and the other exactly in the middle of the breadth of the cloth. The bows and stems of the shears project over the edge of the table, and the workmen place themselves at that edge. Each man guides the shears with his left-hand, and makes the cut with his right. To hold the shears by, a short staff is lashed to the bow of the shears, and secured by a stay to the lower blade; its direction is nearly parallel to the back edge of the upper blade. The workman puts his arm through the bow as far as the elbow-joint, then lays the fore-arm flat against the staff, which he grasps with the hand; and in this way he has a great command of the shears, leaving the right-hand at liberty to work the handle which closes the shears. This handle is moved backwards and forwards with great rapidity, to make cuts or clips on the cloth, and between every cut the lower blade is moved a small space on the cloth, to cut in a fresh part.

The art of shearing consists in moving the shears with great regularity and parallelism, so that every part of the surface shall be equally cropped. The closeness with which the shears cut is regulated by weights laid upon the flat of the lower blade; these press the blade down into the soft cushion on which the cloth is spread, so that the fur will stand up more above the edge of the blade.

As the two shearers advance in their work, their shears proceed across the breadth of the piece of cloth, and when the man who began in the middle has worked to the lift of the cloth, the other who began at the lift will have worked to the middle, where the first began; the whole breadth is now shorn, and they remove the shears, and draw the piece of cloth forwards across the table, to obtain a fresh surface to work upon.

For shearing common cloth, it is cut wet the first time, then it is dressed again with teasels, dried on the tenter, and cut again in a dry state three times over.

Shearing-Frame.— The most common machine used in Yorkshire is only applied to give motion to the same kind of shears as are used for cropping by hand, and is usually called the shearing-frame. At the side of the table or cushion on which the cloth is spread, a long stool is placed, having grooves at the edges to guide the wheels of a carriage, to which the shears are affixed by their bows. There is a carriage for each pair of shears, and they are slowly and gradually moved along the stool, by a cord which winds upon a roller turned by wheel-work; and at the same time, the handles of the shears are continually pulled by a cord connected with a small crank, which turns round very rapidly. The direction of the cuts is the lengthways of the piece of cloth, and the two pair of shears advance across the breadth of the piece until a whole breadth is cut; the machine is then stopped, the shears removed, and the piece of cloth shifted upon the table. These shearing-frames

operate very well, but require great care and attention to make the different cuttings join, in order to cut equally over the whole surface.

The machine invented by Mr. Harmar of Sheffield was of this description; his first patent was in 1787, and another in 1794. At one period his machines were in general use, but the present shearing-frames, although of the same kind, are very much simplified, and work equally well.

A *perpetual Shearing-Machine* is represented in *Plate III. Woollen Manufacture*; it is used in the west of England, and is best adapted for narrow cloths. The shears lay crosswise over the piece, which is drawn regularly beneath the shears in the direction of its length without any interruptions; hence it is called a perpetual shearing-machine.

The shears, E E, are the same as what we have already described. Each pair is fastened across the frame by means of a piece of wood, to which the lower blade of the shears are screwed; immediately beneath this blade is the cushion to bear the cloth, which passes between the blade and the cushion. The piece of cloth is wound round the roller C, upon the end of which is a wheel N, and a lever M, which bears up against the lower part of this wheel with so much friction as to make the cloth strain tight in drawing off from the roller. The cloth first passes over a rail B, from which it proceeds in an horizontal direction beneath the two pair of shears E E, then turns over another rail at the other end of the frame, and descends to a roller D, which is turned slowly round by the machinery, in order to wind up the cloth.

The machine is put in motion by the endless strap round the drum F upon a shaft, which proceeds all the length of the mill. The strap turns the pulley G upon the end of the small horizontal spindle H; in this spindle two cranks are formed at *a* and *b*, which are connected, by wires 7 and 8, with the handles 9 and 10 of the shears E, so as to give them a continual motion, and make a cut of each pair of shears every time the spindle H makes a turn. The motion of the machine can be stopped by releasing the lever P, on which the bearing of the spindle is screwed: when the lever P is depressed, and kept down by the catch, as represented in the drawing, the endless strap is drawn tight, so as to turn the spindle; but if the catch is removed, and the lever raised up, the strap becomes loose, and slips round upon the pulley without turning it. A small pulley is fixed upon the spindle at I, to receive an endless strap which passes round a larger wheel J. Upon the same axis with this are three other pulleys of different diameters, which receive a strap 2, and give motion to three similar pulleys fixed upon a spindle 3: the latter spindle has a pinion on the end of it, which works a bevelled wheel fixed on the end of the roller D, and thus it is turned slowly round. The three pulleys on the spindles 3 and J are placed reversed to each other, that is, the smallest pulley on one is opposite to the largest on the other; by this means, the same strap 2 may be shifted, and will work on any of the three pair of pulleys, but each one will communicate a different degree of movement to the roller D, and consequently to the cloth, so as to draw it quicker or slower, and make the successive cuts of the shears at a greater or less distance asunder at pleasure.

The cushions which bear up the cloth against the shears are moveable on centres of motion, and are capable of being raised or lowered. When they are lowered down, the cloth can be readily introduced beneath the lower blades of the shears; and when raised up, they press the cloth up to the shears, and the force of this pressure can be regulated by turning a small handle. In many machines this motion is applied

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applied to the shears themselves, instead of to the cushion or bed, and is much more convenient.

The perpetual machines answer very well for shearing narrow cloth, when the shears can cut at once across the whole breadth; and then as the two shears E work in succession over the same surface, they crop the cloth twice over in passing once through the machine. It has been attempted to shear wide cloths in this machine, by making one pair of shears take one half the breadth, and the other pair the other half; but it is very difficult to draw a wide piece of cloth so evenly over the cushions, as to keep it stretched to the full breadth without any wrinkles in the lengthways of the piece; and if there are any such wrinkles, the cloth will be cut very irregularly. In this particular, the first machines have the advantage, because the cloth is stretched over the cushion by the workman with discretion, and he makes it tight before the cropping is begun.

There have been many patents for the improvements of shearing-machines. Mr. Buffington's, in 1804, is for a method of stretching or extending the cloth breadthways whilst it is in the shearing-frame. His plan is to attach a narrow web of strong cloth to the lifts of the cloth, by sewing or lacing; the outer edge of this web is also sewed to a cord or small rope, so that the cloth becomes edged or bordered with ropes. These ropes are conducted through holes or openings in the frame, which will suffer the cloth and ropes to be moved in the direction of their length; but as the ropes cannot draw sideways out of these openings, the cloth may be continually stretched in its breadth. The openings should have rollers to facilitate the motion of the ropes.

Mr. Joseph Fryer's patent shearing-machine, dated 1802, acts with three shearing-blades, one long one, which extends across the breadth of the piece to form the lower or fixed blade, and two other moveable blades of half the length, which are jointed to the long blade at the two ends, and are moveable thereon, so as to cut in the manner of scissar-blades. The moveable blades are pressed into contact with the edge of the fixed blade by springs, and are put in motion by means of two cranks upon an horizontal spindle, so that the blades make their strokes or cuts alternately. The edge of the lower blade is a straight line, but the edges of the moveable blades are convex on the cutting side, so as to cause them to intersect the edge of the lower blade always at the same angle when they are wide open, as when they are nearly closed.

The piece of cloth is conducted over proper rollers, and wound up by one, which is turned round by the machine, so as to draw the piece of cloth from one end to the other with a slow and progressive motion. The cloth, when it is immediately beneath the edge of the long blade, is bent suddenly over a narrow ridge of metal, which is parallel with the edge of the lower blade, but so far distant as to permit the cloth to pass between them. This ridge of metal is capable of adjustment by means of screws, and can be placed so that the nap of the cloth will be shorn longer or shorter, as it is required.

In some cases, especially in finishing broad-cloths, instead of drawing the piece from end to end, it may be more convenient to cause it, or part of it, to move under the shearing-blades from lift to lift, or from one side to the other. This will require a machine considerably larger, though the same blades will suffice; or it is found equally convenient to cause the blades, at the time they are cutting, to move over the cloth in any direction, but more especially from lift to lift.

Mr. Fryer also contemplated the finishing of the cloth

by the same machine which performed the shearing. Thus after the cloth has undergone the operation of shearing or cropping, in its passage down to the cylinder on which it is wound up, it is exposed to a current of steam thrown out from a horizontal tube at a number of small apertures, so as to give softness and pliability to the cloth; a brushing cylinder is next made to move against it, by which the remaining wool or fur is laid in one direction. It then passes between two polished metal cylinders, which are made hollow, and kept hot by the admission of steam or otherwise. These occasion a great pressure on the cloth, and dissipate all the water imbibed from the steam.

Rotatory Shearing-Machine.—A very complete machine for cropping cloth of any breadth was invented by Mr. Price, of Stroud, in Gloucestershire, and for which he obtained a patent in 1815. This machine shears or crops the cloth across the breadth, beginning at one end of the piece, and continuing regularly to the other. For this purpose, the cloth is conducted through the machine by the motion of rollers, and is drawn over a bed or support which lies beneath the stationary or fixed blade of the shears or croppers, (which answers to what is called the ledger-blade in the common shears,) so that the cloth passes between the bed and the stationary blade.

The moving blades of the shears are fixed on the circumference of a cylinder situated above the fixed blade, with its axis exactly parallel thereto, and capable of revolving by the power of machinery, so that the edges of the moving blades will be carried against and passed over the edge of the fixed blade, in order to cut away all the wool of the cloth which rises above the edge of the fixed blade. Several such moving blades are fixed upon the same cylinder, to act in succession against the fixed blade; and these moving blades are placed obliquely to the axis of the cylinder, or in such a manner as to form portions of spirals; but as all parts of the cutting edges are equidistant from the axis of the cylinder, it is manifest, that in the revolution of the cylinder, every part of each spiral edge is brought in succession into contact with the fixed blade, so that in its revolution it crops off all the wool, which by the progressive motion of the cloth over its bed is raised up against the fixed edge. The edges of the moving blades are placed at such a degree of obliquity to the axis of the cylinder, that at the same instant the end of one ceases to cut against the edge of the fixed blade, the following revolving blade will begin its action at the other end of the cylinder; therefore, by the time that any one of the revolving edges has passed over and made its cut against the whole length of the fixed blade, and is ready to quit it, the succeeding revolving edge is brought into action, and when this has passed, the next in succession begins, so as to keep up a continued action.

The cloth is stretched in width by a contrivance which he calls stretching-bands, to prevent it getting into folds or wrinkles, which would be injured by the shears, or make irregularities in the shearing. These stretching-bands are endless straps or bands, each of which is extended over two wheels. The bands have sharp pins projecting from them to prick into the lifts at the edges of the cloth, and the bands being so situated that one of them lies exactly beneath each lift, they will be caused to circulate round their respective wheels by the motion of the cloth. The stretching of the cloth is effected by the position of the wheels on which the bands circulate, the direction of the bands being slightly oblique to the lengthways of the cloth. The endless straps are so fitted into grooves or troughs, that they are firmly retained to move straight forwards in their oblique direction; and the direction of the obliquity is such, that the

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bands are nearest together at that end where their pins take hold of the lifts of the cloth; but as the bands move forwards with the cloth, they recede from each other, and extend the cloth in breadth in consequence of their obliquity, which may be increased or diminished as is found necessary. The actual width between the two bands can also be regulated according to the width of the piece of cloth.

It is not usual to crop the lifts of the cloth, and indeed as the lifts are usually of thicker substance than the other parts of the cloth, they would bear up the fixed blade too high from the cloth to cut the nap quite close.

For this reason, the bed or support on which the cloth is cut is so constructed, that it can be adapted in length to the breadth of the piece of cloth between the lifts, in order that the cloth only may be supported or borne up to the edge of the fixed blade; whilst the lifts, being depressed or borne down below the level of the bed, (by thin slips of metal called guards,) will escape the action of cropping, and thereby remain with the long wool upon their surfaces. The bed by which the cloth is borne whilst it is cut is only a narrow ridge of metal, over which it passes, so as to be bent with a sudden curvature, and in this way, the nap can be cut more close and even than upon a flat bed or soft cushion. The operation of cutting is facilitated by a row of pieces of metal screwed to a strong bar, to form a straight edge, very similar to the cutting edge of the fixed blade, but thin and elastic; this edge is placed close to the elevated ridge of the bed, and presses the cloth gently down upon the bed immediately before it comes to the edge of the fixed blade, against which the nap is to be cut off; this elastic edge being placed on one side of the ridge, and the cutting edge of the lower blade on the other side, the cloth is only exposed for a very narrow space just where it comes to the cutting edge. By this means, the cloth can with safety be brought nearer to a level with the upper surface of the fixed blade, so as to shear it closer than could otherwise be done without endangering the cloth.

The ends of the ridge part of the bed are composed of a number of narrow plates of metal, accurately fitted together, and placed side by side in a mortise made in the end of the solid bed; their upper ends project out of the mortise so as to line with the elevated ridge, and form a continuation thereof; but there is a sliding piece in the bottom of the mortise on which they all bear, and the point of it is of a wedge form. By removing this wedge, any number of the moveable pieces may be let down, so as to diminish the length of the elevated part of the bed at pleasure, according to the breadth of the cloth. The whole of this machine is very well contrived to effect the desired object; it will be found fully described with drawings in the *Repertory of Arts*, vol. xxix. p. 65.

Frizing is an operation sometimes used in the finishing of woollen cloth: it consists in rolling up and entangling the fibres, which form the nap on the surface of the cloth into small knots or burs, which cover near the whole surface, so that the cloth appears covered with small grains, which almost touch each other.

This operation is of no utility to the cloth, and it is difficult to say for what reason it was ever practised at all. The French first introduced it, and it was so much the fashion many years ago, that no other cloth was thought comparable in beauty. At present it is but little used, except for foreign markets, where our cloth meets the French cloth, which is still prepared in this manner, but generally on the back-side of the cloth only.

The frizing is done by a simple machine, in which the cloth is drawn across a narrow table by means of rollers,

to give it a very slow progressive motion. The table is covered with a coarse strong cloth, and over the table is placed a heavy plank of wood, of the same size as the table. The lower side of this plank, which bears upon the cloth, is covered with an artificial stone, composed of coarse sand, which is stuck together into a solid mass by glue or other cement, and a small but rapid reciprocating motion is given to the plank by means of two cranks of very small radius. These cranks are formed at the tops of two vertical spindles, the upper ends of which are fitted in sockets at the ends of the fixed table, and the ends which project up a few inches above the surface of the table are received into sockets formed in each end of the moveable plank. The projecting parts of the spindles are not in straight lines with those parts which are fitted in the fixed collars at the ends of the table, but are slightly cranked; hence, if the spindles are turned round, they must communicate motion to the plank, and slide it over the cloth backwards and forwards; or rather they move it with a circular motion, causing every point and grain of sand cemented to the plank to describe a small circle upon the cloth. It is this action which gathers together the fibres of the nap, and entangles them into knots or grains, as before mentioned.

To put the two spindles in motion, each one has a trundle or lantern fixed on the middle part of it, and the lower end is received in a stationary socket. These lanterns are turned round by the teeth of two face-wheels, fixed upon an horizontal axis, which lies beneath the machine. By this means, both the spindles and cranks are turned round at the same time, and with a very rapid motion. The rollers which draw the cloth forwards are turned round slowly by a communication of wheel-work, and draw the piece of cloth through the machine, that is, across the frizing-table, so that every part is in turn subjected to the action of the sand cemented to the plank. The nap must be left long for that cloth which is intended to be frized, and the operation is repeated twice or three times. See some further particulars in our article *FRIZING*, vol. xv.

Brushing.—After being shorn for the last time, the cloth is brushed all over, to remove the loose cuttings. This operation is now commonly performed by a machine which has two horizontal drums, or cylinders, covered with hair-brushes on the circumference. The piece of cloth is conducted over a system of rollers to extend it and draw it slowly forwards: it is conducted over one of the brushing-cylinders, and under the other; and as they are kept in rapid motion by the machine, they brush over both sides of the cloth at the same time, and lay all the fibres one way.

Pressing.—This is the last finish to the cloth, and gives it a smooth and even surface. The piece of cloth is folded backwards and forwards at every yard, so as to form a pack on the board of a screw-press; and between every fold sheets of glazed paper are placed, so that no part of the surfaces of the cloth can come in contact; also at every twenty yards three hot iron plates are put in between the folds, the plates being laid side by side, so that they occupy the whole surface of the folds; and thin iron plates, which are not heated, are also put above and below the hot plates to moderate the heat. When the pack of cloth is properly folded, and the press contains a proper quantity, the screw is forced down to give a very severe pressure to the pack. The cloth remains in the press until the plates are quite cold; it is then taken out and folded again, so that the creases of the former folds will come opposite to the surfaces of the paper, in order to be pressed with other hot plates.

The heat tends to soften the fibres of the wool, and the pressure

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pressure against the glazed paper, whilst they are so softened, lays all the fibres flat and smooth, so that the cloth has a very glossy appearance, and feels smooth, like satin; but this high finish to the cloth is very objectionable, because the slightest shower of rain will take it away, and when the drops of rain only wet it in parts, the cloth will become spotted and disfigured. For this reason, in pressing superfine cloth, the plates are very slightly warmed, and the cloth has but little gloss given to it. The glazed paper is a thick kind of cartridge, which is prepared by glazing or rubbing it very forcibly with a flint, as it lies upon a hard metal table. This operation is done by a water-mill.

For coarser cloths, some manufacturers gloss them with a large hot iron: it is a hollow box, into which a red-hot heater is introduced. The cloth is spread out upon a large flat table, and extended by hooks. The iron box is suspended by a tackle from the ceiling, so that it can be hoisted over to the middle of the table, and then two men work it backwards and forwards over the whole surface of the cloth, by means of two long poles or handles, which are jointed to it at one end.

The cloth is now finished, and is packed up in bales of twenty or twenty-five pieces, in order to be transported. The bale is first inclosed in paper, and then in canvas, and closely compressed by the screw-press. Some manufacturers use the hydrostatic presses for this purpose.

In considering the processes of the woollen manufacture, as they were practised forty or fifty years ago, and comparing them with the present practices, we find great changes and improvements, but they are by no means carried to so great an extent as in the cotton manufacture. This is owing in a great degree to the circumstance that the manufacture of woollen cloth was rendered very perfect, as far as the goodness and beauty of the cloth was concerned, long before the improved system was begun; and there were great numbers of experienced and able workmen trained up for each process, who by habit and dexterity performed their work as well as it could be done by machinery. The reduction of labour, or the substitution of ordinary hands for experienced workmen, was in this case all that machinery of the most perfect kind could effect; both these were advantages to the public and the manufacturer, but were so directly opposite to the inclination and interest of the able workmen, that we find they have made greater and more effectual opposition to the introduction of improvements in the woollen than in any other of our great manufactures.

At various periods attempts have been made by the workmen to suppress machinery, and many mills have been destroyed. In July 1802, considerable riots took place in Wiltshire and Somersetshire, in consequence of an attempt to set up the machines called gig-mills. It was contended that this was the same machine which was prohibited by an ancient statute of Edward VI. The disputes ran so high, that the attention of parliament was called to the subject of the laws then existing for the regulation of the woollen manufacture, and a committee was appointed to investigate the policy of encouraging or regulating machinery. In consequence, all the prohibitions of machinery were suspended. The report of this committee contains the following remarks, some of which are applicable to other manufactures as well as the woollen.

The introduction of the gig-mill and other machines was opposed from an idea that it would throw a considerable number of hands out of work; and it was contended, that it was highly injurious to the quality and texture of the cloth. With respect to the actual effects of the gig-mill and shearing-frame on the cloth, the committee report that deci-

five evidence has been adduced before them by merchants and manufacturers of the greatest credit and experience, to prove that these machines, especially the gig-mill, when carefully employed, finish the cloth in the most perfect manner, and that manufacturers residing in parts of the country where the gig-mill is not used, frequently send their cloths to a distance to be dressed by it.

It also appeared in evidence, that alarms similar to the present had existed among workmen at the introduction of several of the machines which are now in general use. Such alarms have gradually subsided as prejudice died away; and the machines are now fully established, without, as it appears, impairing the comforts or lessening the numbers of workmen. The committee remark with much satisfaction, that in many instances in which it was apprehended that the introduction of particular machines would throw such a number of people out of employment as to occasion great distress, the result has been very different; for besides the occupations which the attendance on such machines has given rise to, a fresh demand for labour to an immense extent has arisen out of the increased sale of the article, in consequence of the cheapness and superior quality of the manufacture.

They approve the system of patents, by which the inventor of any new machine secures to himself the exclusive benefits of his discovery for fourteen years; and only, at the end of that term, they are thrown open to the public; this provides in most cases against the too sudden and general establishment of any invention, by which a number of workmen might at once be thrown out of employment.

They next observe, that if the principles on which the use of these particular machines is objected to were once admitted, it would be impossible to define the limits or to foresee the extent of their applications. If the parliament had acted on such principles fifty years ago, the woollen manufacture could never have attained to near its present extent. The rapid and prodigious increase of late years in all the manufactures and commerce of this country is universally known, as well as the effects of that increase on our revenue and national strength. In considering the immediate causes of that augmentation, it appears to the committee, that it is principally to be ascribed, under the favour of Providence, to the general spirit of enterprise and industry among a free and enlightened people, left to the unrestrained exercise of their talents in the employment of a vast capital, pushing to the utmost the principle of the division of labour, calling in all the resources of scientific research and mechanical ingenuity, and, finally, availing themselves of all the benefits to be derived from visiting foreign countries, not only for forming new and confirming old commercial connections, but for obtaining a personal knowledge of the wants, the taste, the habits, the discoveries and improvements, the productions and fabrics, of other civilized nations. Thus bringing home facts and suggestions, perfecting our existing manufactures, and adding new ones to our domestic stock; opening, at the same time, new markets for the product of our manufacturing and commercial industry, and qualifying ourselves for supplying them.

The committee declare it to be their opinion, that by these means alone, and above all by the effect of machinery in improving the quality and cheapening the fabrication of our various articles of export, notwithstanding a continually accumulating weight of taxes, and with all the necessaries and comforts of life gradually increasing in price, (the effects of which on the wages of labour could not but be very considerable,) our commerce and manufactures have also been increasing in such a degree as to surpass the most sanguine calculations of the ablest political writers who have specu-

lated on the improvements of a future age. The exports of woollen goods at the time of this report, (1807,) amounted to six millions of pounds official, or nine millions of real value.

It appeared also to be an important consideration, of which we should never lose sight, that we are at this day surrounded by powerful and civilized nations, who are intent on cultivating their manufactures and pushing their commerce; and who are more eager to become our competitors in trade, from having witnessed the astonishing effect of our commercial prosperity. The attempts which have been made to carry our machines and implements over to foreign countries, and to tempt our artificers to settle in those countries, evince the importance of machinery, under the directions of men of approved skill, in constructing and using them. It is needless to remark how much these attempts would be favoured by our throwing any obstructions in the way of enterprise and ingenuity, and the free application of capital in this country; for any machines which should be prohibited here would infallibly find their way into foreign nations in a very short time.

Among the attempts to improve the woollen manufacture, we must not omit to notice the invention of Mr. Joseph Booth, for fabricating woollen cloth without spinning or weaving. This was effected by felting wool into a web by the aid of machinery, which operated mechanically upon a tissue of carded wool, to entangle and interlace the fabrics together. The inventor took a patent for this in 1793 or 1794, but before the time for the enrolment of the specification of his process, he obtained an act of parliament, the preamble of which states, that on account of the great importance of the art, and the danger of its being carried abroad to the injury of the staple manufacture of the kingdom, parliament had determined to keep the specification sealed; hence we are not able to give the details of this machinery.

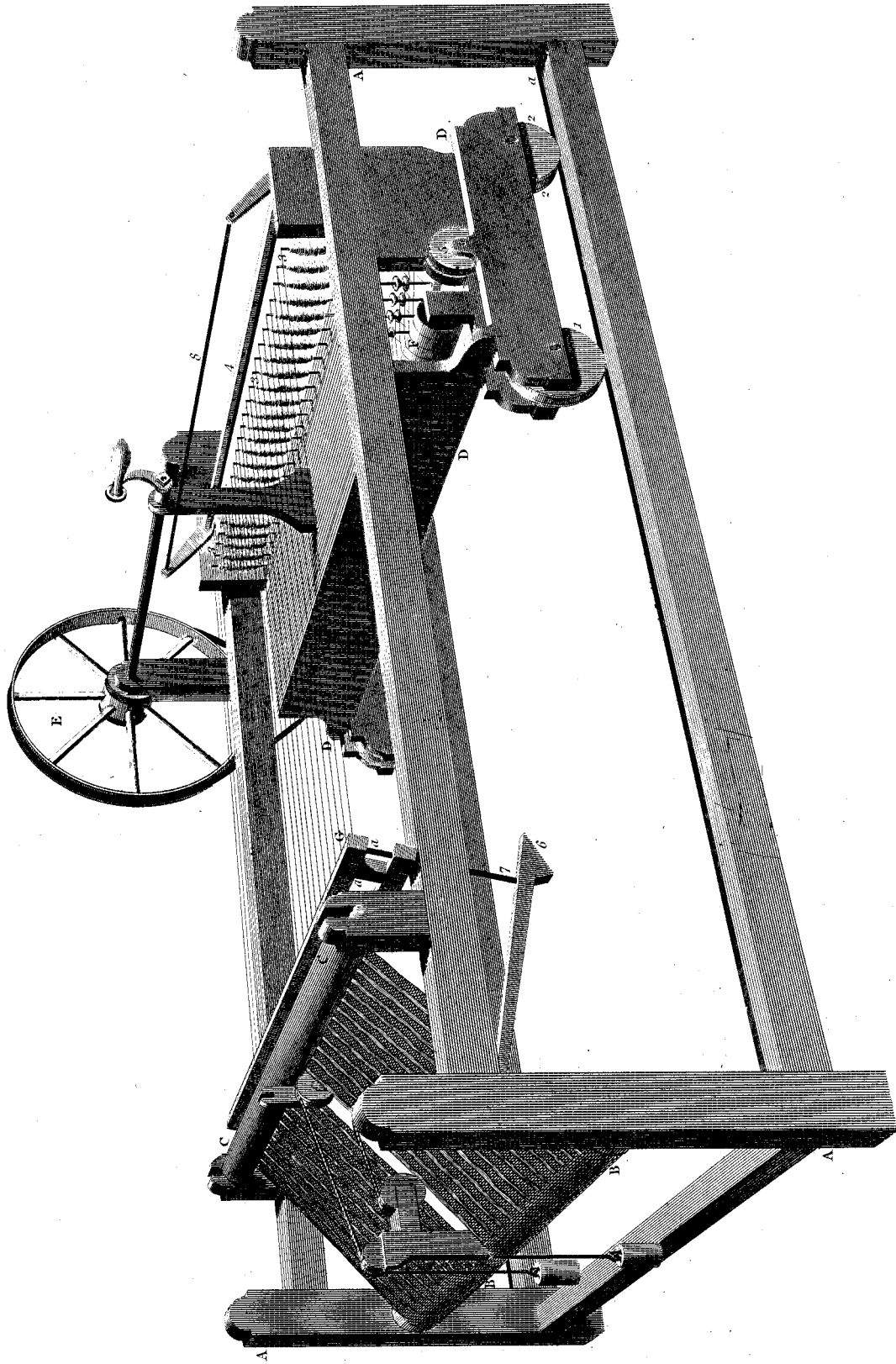
We find these expectations have not been realized; for, although the process has been repeatedly tried on a large scale and in the most complete manner, it has been abandoned. Three large mills were established at Taunton and near Salisbury, by experienced woollen manufacturers of the west of England; another mill was converted to the purpose at Lewisham, in Kent; and the last mill was erected at Merton, in Surrey, the property of James Perry, esq. We learn from this gentleman, that he was able to manufacture cloth of a fine surface, and of a very even and regular substance, but it was rather deficient in strength, for want of the threads which form the substance of common cloth; and in respect to wear it was less durable than common cloth, as it did not long withstand brushing; otherwise the expense of the process, which was not one-fourth of the common process, would have brought it into general wear.

There has been a great number of other projects and patents for the improvement of different branches of the woollen manufacture; but as we have already noticed most of those which have come into use, we shall not enumerate any more of the unsuccessful attempts.

The machinery for manufacturing long combed-wool is described in the article WORSTED.

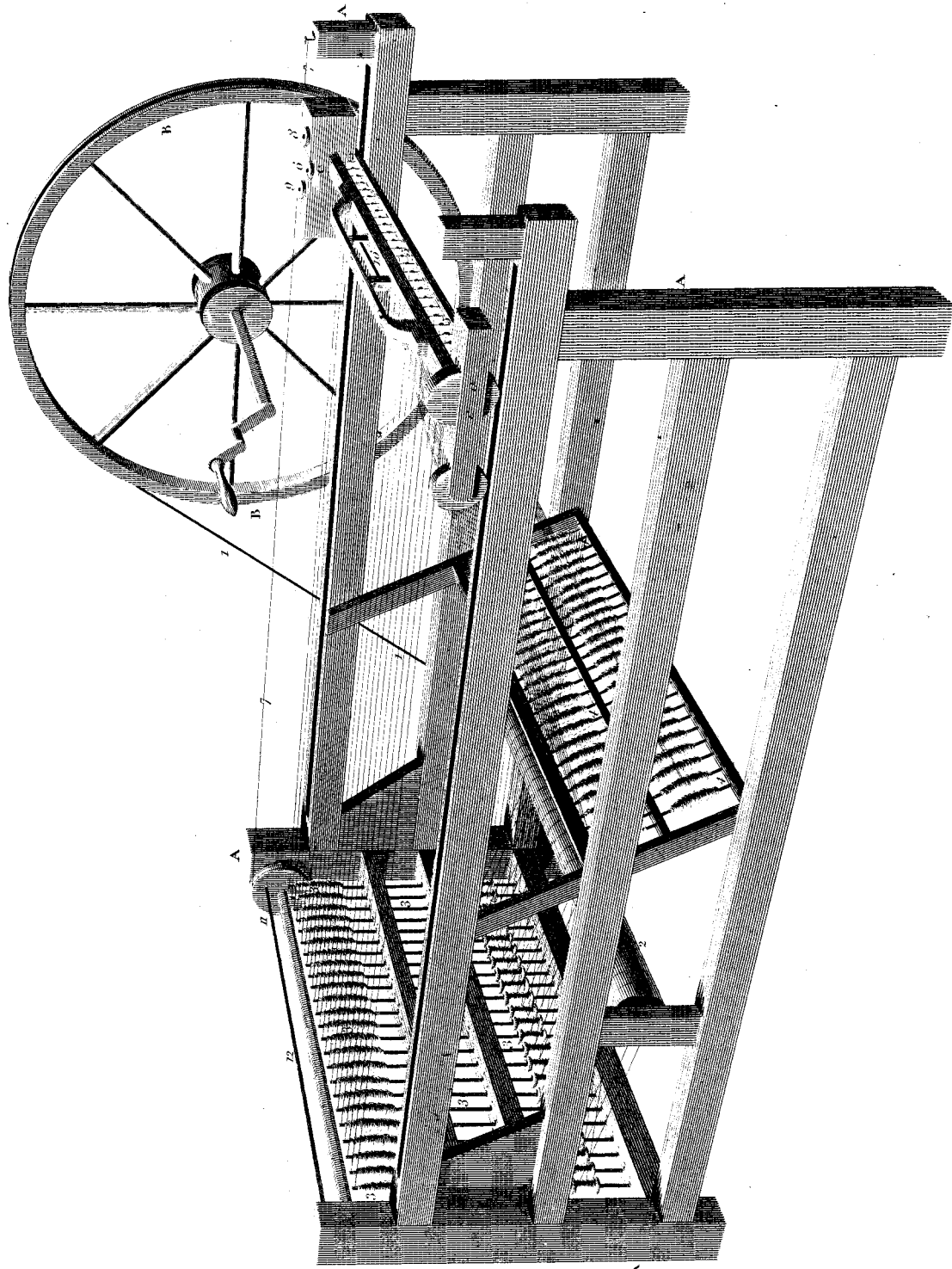
WOOLLEN MANUFACTURE.
SLUBBING MACHINE OR BILLY.

PLATE I.



WOOLLEN MANUFACTURE.

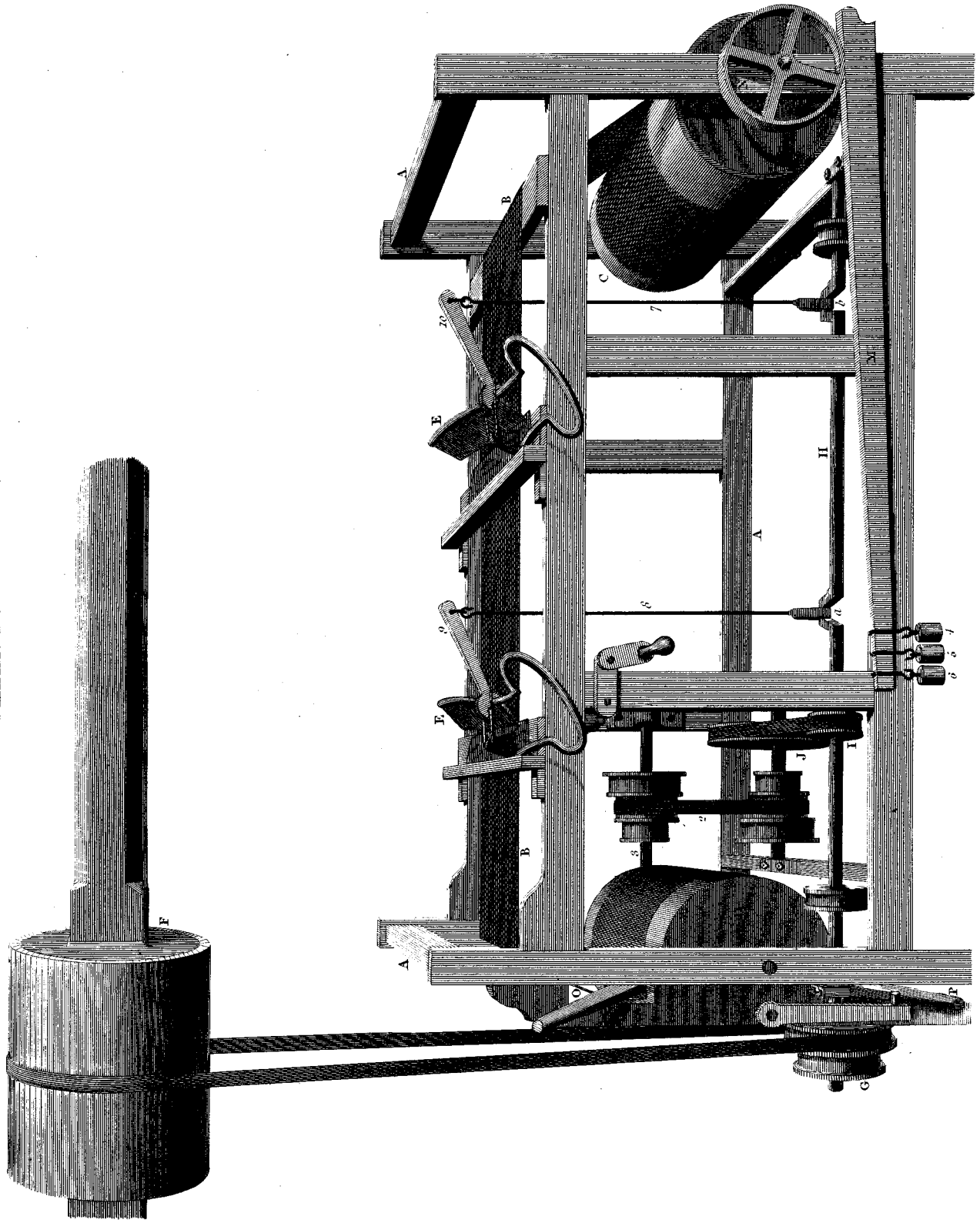
SPINNING JENNY.



Emery sculp.

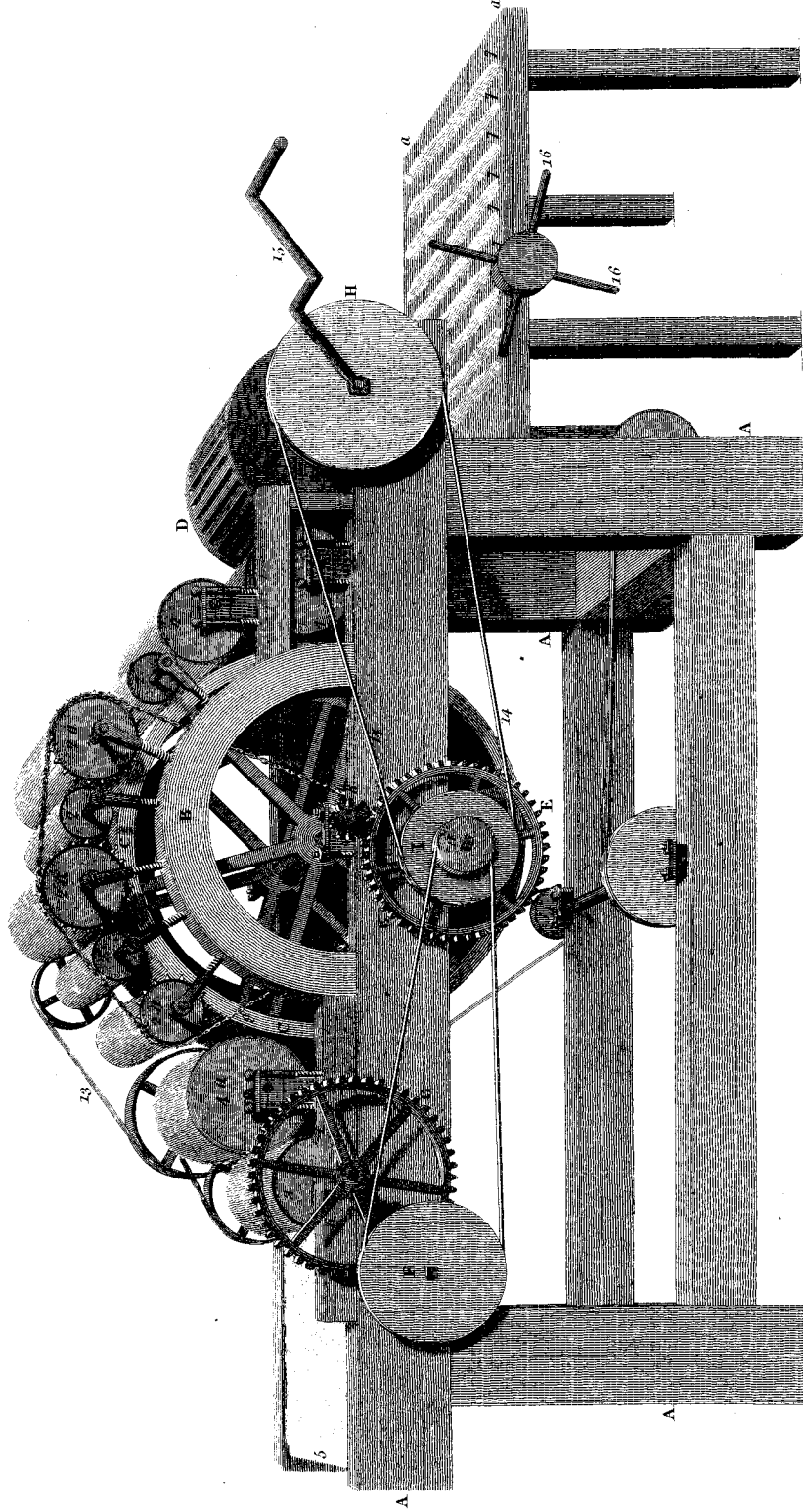
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WOOLLEN MANUFACTURE.
SHEARING MACHINE.



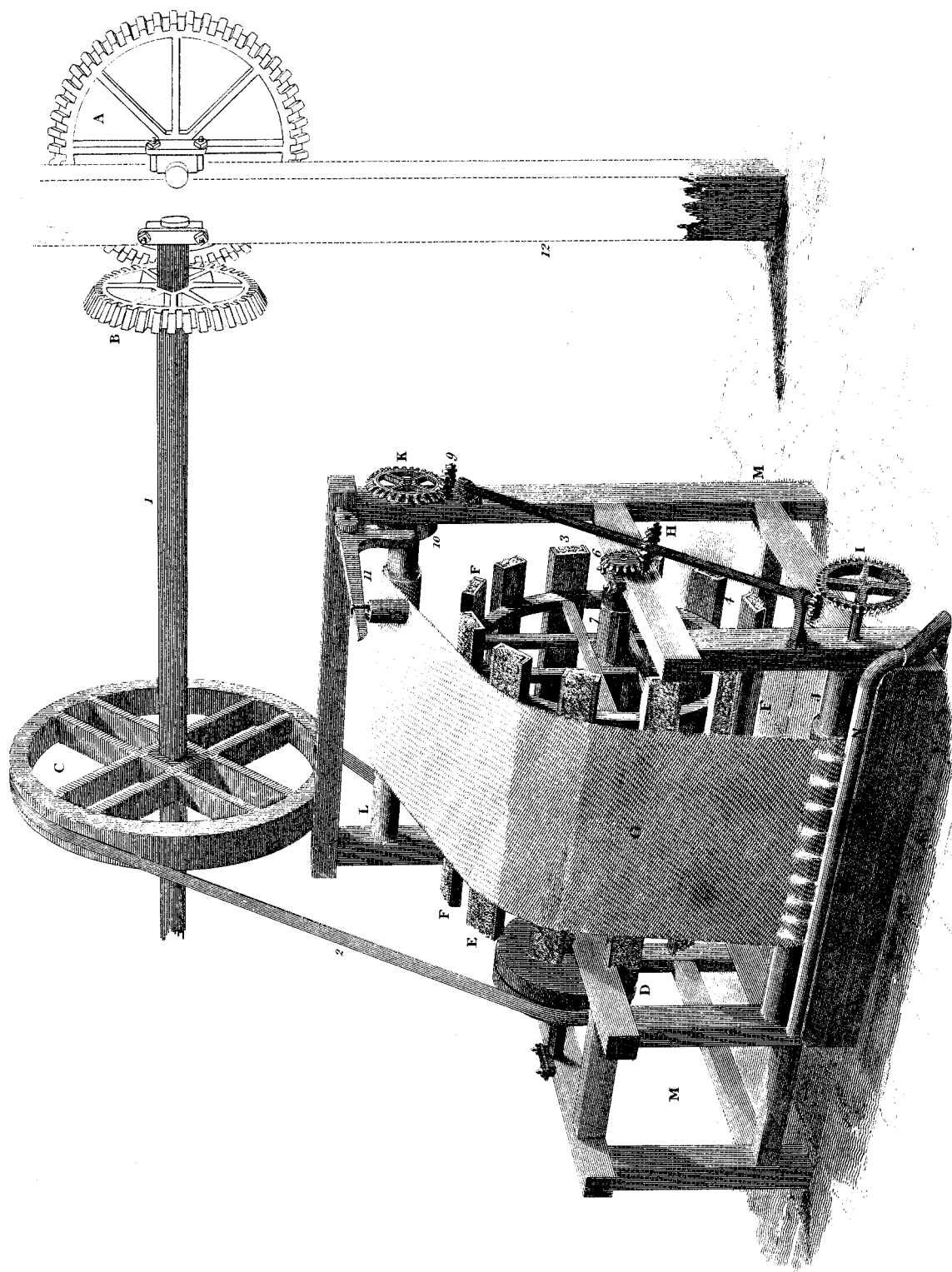
WOOLLEN MANUFACTURE.
CARDING ENGINE.

PLATE



WOOLLEN MANUFACTURE

PLATE V.



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Lovry, Sculp.