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Thus, in addition to the superior pliability and comfort of woolen 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. Luceock, were little more in the hands of the first manufacturers, than the spindle in the hands 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 respects 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, itself, perfect, than that which was practiced 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 wrapped, 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 leaf 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 teasel or thistle, the diapausa fullorem, 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 cardaus, or teasel. 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 woolen manufacture, the improvements made in spinning or weaving of wool were effected by the improved adders and skil 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 whose terms were synonymous. The produce of fine wool from sheep is entirely the result of cultivation; it has never been grown except in countries were the woolen manufactures have flourished. The race of fine-wooled sheep has, however, been partly preferred 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 excellence, and the estimation in which they were held. To produce them in their richest

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luftre, a fection of the wool mof adapted to receive them might be made, and this would operate with great precision upon the wool-theurter's attention.

While the manufacture of wool was confined to the houfes of the grower, and the bifsnefs of it tranfacted by his domestics in a defcult state, there was left room for the imitation and exercife of invention than in after-ages, when it became the appropriate calling of one particular part of the community, and their succif depended upon the opinion which others formed of the fabric. Yet in the fimpel days of Greece, it was not deemed an employment unfit for palaces, nor did a princefs degrade her dignity by superin-
tending the labours of the loom, the diftiff, and the dying vat.

We have little information respecting the woolen manu-
factures of the Greeks and Romans, as diftinct from their domestic manufactures; but large establishments were nec-
fary for the clothing of diftant armies, and for foreign com-
merce. 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-woofled sheep, and by the high prices at which the wool and sheep were fold, as appears from the writings of Pliny, Varro, and Columella. Pliny defcribes two kinds of sheep: the one which grew coarse long wool, and was on this account called kirtum or birfatum, and from its hardines and ruder treatment colo-
nicum or rustic; the other breed was called molle, from the softness of the wool, and genofrum or noble, from its ex-
cellence; also pellium, from its being clothed with fkins to protect the wool. The race is sometimes also called Taren-
tinum, Apulum, Calbrum Atticum, and Graecum, from the neighbourhood or district in which it chiefly lived; but what is of more importance, as shewing the origin of the fine-
woofled sheep of Italy, the race is called Afiainum; and,
according to Pliny, a similar race existed in his time at Laodicea in Syria. The defcription given of thefe sheep by Pliny agrees with the prefent race of Merino sheep. There is not, says Dr. Parr, throughout Europe, any breed of short-woofled 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 Statius and Pliny. The former writers, who flourished in the reign of Augustus, says, that in Tur-
detania in Portugal, then a part of Spain, they formerly imported many garments, but now their wool was better than that of the Coraxi, and fo beautiful, that a ram for the purpofe of breeding was fold for a talent, and that fabrics of extraordinary thimfnes were made of this wool by the Saltirata. Probably this was similar to the shawl cloth of India, and woven in the fame manner, as Pliny calls it scutalus, a term which he applies also to the spider’s web.
The little attic tale of silver is estimated to equal in value 21f. of English money, which shews the high eftima-
tion in which the beet 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 Vogel-
cius, was equal to a pound of gold. A people fo pre-
eminent in wealth, and in all the refinements of art, would naturally be folicitous to attain the highest degree of ex-
cellence in the manufacture of those fabrics, which were calculated to gratify their paffion for adorning their perfons, and it was equally as neceffary to consult their eafe as

their vanity. The summerheat of Italy was fo great, that the affluent could scarcely have supported a woollen driff, had it not been made of the lightest and thinnest cloth. We find also, that during the Augustan age, and for a con-
derable time afterwards, it was the fashion to wear cloths which, as at prefent, were furnished with a rafed nap or pile. Such cloths were called pexae, in contradifnition to tritex or thread-bare. Thus Horace:

"Si forte subueba pexae
Trita sub eft tunicae — rides."

"You laugh if you efy a thread-bare vest
Under a well-drefsfed tunic."

And alfo Martial:

"Pexatus pulchræ, rides mea, Zoile trita."

The term pexatus, applied to cloth, leads us to fuppo-
se that the nap or pile was rafed with a comb, having very
fine teeth. Pliny informs us, that in his time the price of wool had never exceeded 100 festeri the libra, or pound; now the Roman festeri being about 8s. of our money, and the libra about 5245 grains, it follows that an avoirdupois pound, or 7006 grains, would have cost about 1/. 2s. of our money. From the intercoufe of Perfia and the East, the Romans would become acquainted with the fhawl-cloths of India, and would naturally wish to imitate so beautiful and delicate a fabric. These are made from very fint fine short wool, and not from cambed wool, as has been gene-

rally suppod in this country. The eftinction of that ma-
nufacture in Hindooftan 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 fhawl-cloth is only woollen cloth, woven with a twill, and unmilled, but it is fpun to a great degree of fineness, and from wool so pefcularly soft, that it has never been rivalled by any Eu-

ropean nations. The perfection of the colours, and the skill displayed in the weaving, we have no reafon to believe are greater now than in the time of Alexander the Great; and if these manufactures were fuccedfully imitated by the Greeks or Romans, or even diftantly approached in the ma-
nufacture 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 favage barbarians, all their public establishments and ma-
nufactures were destroyed, but the art of producing from the fleece a warm and substantial clothing was never entirely lost, even during the darkeft days of ignorance. It began to revive, and became the feparate occupation of one clafs 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 confumed for the first few years was the produce of their own paftures, 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 diance. The wealth which it distributed was foon visible, and people crowded into the country, engaged in its commerce, and publidh their fcnculations with increasing vigour through a hundred and fifty years, when an inundation of the sea threatened to involve the art, the artif, and the country, in one general deftuction. The difperion of the people who fled from the calamity which appeared to overwhelm their hopes, in-

stead of defroying the infant manufacture, gave it additional vigour, and was the means of eftabllishing a connection be-
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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 woolen manufacture, from the ruin which seemed to threaten them, and gave a striking instance of their partiality for the rents 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 such 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 wool of other countries, to extend their connections much more widely, and to grow by this means fill more richly and powerfully 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 expense 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 dockyards 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-wooled sheep were cultivated with success by the Romans. See SHEEP.

This breed, intermixed with the native flocks, gave rise to the present fine-wooled 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 vines, favoury in milk, clarouson in hunting, and glutinous in herds and flocks,"—gala armentis et agricibus. He wrote in A.D. 1245. In England at that time, sheep were so scarce, that awool at this time 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 revenue 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 Sevilles 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 manufacture of woolen cloths. According to Ulalrus, "The 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 woolen cloths of Barcelona were in high esteem in Sevilla in the reign of that prince, and in the preceding century. So far back as 1243, the woolen cloth of Lerida is spoken of in arms of Edward Longshanks. A few years after, Bauhais, Valis, Gerena, Perpignan, and Tortosa, were remarkable as manufacturing towns, and for the fineness of their cloths, tissus, and fersges. 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 Catalanian ships in 1412, by Antonio Dorco, in the port of Callis. 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 disclaiming to wear it.

According to Lucius Marinius Sicilus, 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 20,000 or more 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, sallied, among other points, that the cloths imported into Spain should be of the same size and goods as those wove there; and that the merchants and clothiers might have leave to seize, in order to work up half the wool by sale 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, preferred in the Faderma, from queen Elizabeth to Cofino de Medicis, 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 tallant 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 1s. 1d. of our present coin. This wool was, therefore, worth at least 5l. 14s. 7d. the sack of 1813 lbs., and 11l. 9s. 2d. 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 fend annually from Spain to Bruges more than 40,000 sacks, but that in this year the Spaniards, having made more cloth at home, had lost only 25,000 sacks, at 25 crowns each." The crown being 42 and the shilling 1s. 4d. of our money, this would be 1s. 11d. the sack of 364 pounds. The depreciation seems in truth to have arisen from a diminished demand for this wool in the Netherlands. The woofs imported into the Netherlands from Spain were the lower or coarser kinds.

The superfine woofs 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," 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 5s. the stone of 14 pounds, of 6l. 10s. the sack of 364 pounds. The shilling, however, being then equal to 1s. 4d. of our coin, increases the price of the sack 5l. 18s. 9d.; to which add custom and subsidy, 3l. 11s. 4d. or 3l. 11s. 4d., and the result will be 13l. 19s. 7d. The additional charges of freight and merchant's profit would scarcely bring the whole amount to 16l. 16s. On the other hand, according to the testimony of Damianus a Goes, the Spanish sack of 1814 pounds was in 1541 worth 14l. 6s. 11d., and the sack of 364 pounds 28l. 14s. 6d. 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 woolen 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 Insecurity," writing in 1641, tells us, that "the greatest part of their (the Venetians) woofs 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 which that 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 preferred 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, above 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 abjured policy of her rulers, in the revocation of the edict of Nantes, 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 bred over the country, and are equal to, and supply extensively her supplies. 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 tammies and shallobns, 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 woolen 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 Elbeuf.
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 finest 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 breadths: 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 kinds, and the proportion of the fine to the superfine was greater than at Sedan.

Elbeuf was one of the most ancient seats of the woolen 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 better 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 woolens were much more widely spread over France. The goods appear to have been principally furnished in that country as it supplies 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 woolen cloths, the manufactures of these articles never equalled in extent those of England. The circumference 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; but 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 woolen goods.

The worsted manufactures of France, including serges 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 Encyclopedia, describing the French manufactures in the year 1785, 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 waiting 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 Marseille, in bales of from 200 to 300 lbs. It fold from four livres to twelve livres per French pound; the price of that molt generally used was about 4 livres 10 sous per pound. The filks used in silk camletots, &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.

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity (lbs)</th>
<th>Price (livres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>French wool</td>
<td>320000</td>
<td>22</td>
</tr>
<tr>
<td>Dutch ditto</td>
<td>180000</td>
<td>40</td>
</tr>
<tr>
<td>English ditto</td>
<td>200000</td>
<td>32</td>
</tr>
<tr>
<td>German ditto</td>
<td>100000</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>368000</td>
<td>431000</td>
</tr>
</tbody>
</table>

### Yarn imported.

<table>
<thead>
<tr>
<th>Yarn Description</th>
<th>Quantity (lbs)</th>
<th>Price (livres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkish wool</td>
<td>6000</td>
<td>8 10</td>
</tr>
<tr>
<td>German yarn</td>
<td>10000</td>
<td>7 0</td>
</tr>
<tr>
<td>Levant yarn, or</td>
<td>220000</td>
<td>5 10</td>
</tr>
<tr>
<td>Mohair</td>
<td>121000</td>
<td>7 0</td>
</tr>
<tr>
<td>Total</td>
<td>743000</td>
<td></td>
</tr>
</tbody>
</table>

Total value of wool and yarn brought in, 4 M 2.
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Brought forward 743,000
Combing and spinning 368,000 lbs. of wool 431,000
Winding, warping, and weaving 477,000
Dyeing of yarn and pieces 190,000
Profit of the wool-dealers, manufacturers 130,000

Total value of 15,000 pieces coming from
the manufacturer 1,200,000
Value of dyeing-wares 50,000
To which carriage and profit of the merchant and draper 200,000

Total value of worsted goods in Picardy 205,000

One million and fifty thousand pounds weight of wool were also consumed in bobbins 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:

- 50,000 men who gain 140 livres per annum 700,000
- 50,000 women 350,000
- 15,000 children 600,000

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 woolen 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 astoundingly increased, and have obtained a decided preference in foreign markets.

The woolen 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 woolen 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 woolen, we have little information respecting its origin. It comprises all those goods made of combed wool in distillation 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 accidental 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 manufactories 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 woolen 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-sapped 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 woolen 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 Diocletian, 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 fection.

Rife
WOOLLEN MANUFACTURE.

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 inter-

wool 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 drabs 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 mission 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 dres of the labouring mechanics at that time, to which clafs he belonged.

The first account of any foreign weavers settled in England is recorded by William of Malimbus and Giraldus Cambrensis, who relate that a number of Flemings were driven out of their own country, by an 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 Pembroke sheriff. 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 paid fines to the king for the privilege of carrying on their trade. (Chronicon Pictiolum, p. 64.) There were also cloth dealers in various parts of Yorkshire, Norwick, Huntingdon, Gloucester, Northamton, Nottingham, and Newcastle upon Tyne; also several towns in Lincolnshire, and at St. Albans, Balduck, Berkhamstead, and Cheshfield, 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 introduced under the pretext of the inferiority of the Spanish wool, but was doubly 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, ruffets, &c. to two yards within the city. In the year 1254, foreign merchants were 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 fold all their goods, and received a commissio upon them. It was soon after pretended that the foreign merchants used false weights, and a despatch 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 Peroull le Tailleur, 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 Pierre de Edmonton have it, if he were fit for it, and a writ was made out accordingly, and he took the oath 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. There is no doubt that a new impulsion was given to it during this reign by the liberal protection granted to foreign manufactores here; in all probability, they first introduced the manufacture of fluffs 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 tailor merchant from Flanders, received a protection to establish himself here with a number of dyers and fuller 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 emigrants without fulpiction, to invite the manufacturers to this kingdom. These manufacturers were distributed over the country, at the following places:—The manufacturers of fullians (woollens) were established at Norwich, of jaines at Sudbury in Suffolk, of fayres and ferges at Colchester in Essex, of broad-cloths in Kent, of kervies in Devonshire, of cloth in Worcestere of Gloucester, and of Welsh friteres in Wales, of cloth at Kendal in Westmoreland, of coarles cloths, afterwards called Halifax cloths, in Yorkshire, of cloth in Hampshire, Berkshire, and Suffolk, and of ferges at Taunton in Devonshire. (Rymer's Foeder, 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 Shakespeare as an article of dres 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 1356, two woollen manufacturers from Brabant settled at York, under the king's protection; they are filled in the letters of protection, "Willlemus de Brabant & Haneckins de Brabant, Textores." These persons probably laid the foundation of the woollen and worsted manufactures which have since (as we shall see) become flourishing in the western part of that county. It is not very improbable, that the manufacturer Hancks, called Haneckins, gave
WOOLLEN MANUFACTURE.

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

The references which we have found 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 harassed by the disputes 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 exactation. The letter to the mayor and bailiffs accuses them in the following terms: "vos diversas pecunias summas ad eisdem Thomas et aliis exigitis et ea occasione multipliciter iniquitatis ut 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 tend their goods for sale, in the year 1537.

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 subagents. 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 the exchequer, was published by Edward Melford, merchant, in the year 1623.

Exports.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thirty thousand six hundred and fifty-one facks and a half of wool, at six pounds value each fack, amount to</td>
<td>£ 189,909 0 0</td>
</tr>
<tr>
<td>Three thousand thirty-six hundred and sixty-five felts at 40s. value, each hundreded at six score, amount to</td>
<td>£ 6,073 1 8</td>
</tr>
<tr>
<td>Whereof the custom amounts to</td>
<td>£ 81,624 1 1</td>
</tr>
<tr>
<td>Whereof the custom amounts to</td>
<td>£ 89 3 0</td>
</tr>
<tr>
<td>Whereof the custom amounts to</td>
<td>£ 617 6</td>
</tr>
<tr>
<td>Carried forward</td>
<td>£ 277,702 5 3</td>
</tr>
</tbody>
</table>

Imports.

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

Summary of the in-brought commodities, in value and custom, is £ 38,970 13 3

Summary of the impulse 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 woollen goods had become an article of manufacture, nearly equal in importance with the woolen; 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 Somerset, 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 fame cloths flowed outwards, but falsly wrought with divers wools, to the great loss and damage..."
WOOLLEN MANUFACTURE.

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 market 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 sore. 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 describe as "being a strong company, and underlet with rich men." It is not, however, very probable, that this company would continue to purchase goods without a prospect of gain. Thence 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 wrought 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 warehoues 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 reproached 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 fall again to foreign merchants; to which menace one of them pointedly replied, "My lord, the king may buy them as well at Blackwell-hall, if it pleases him, and the strangers will gladlier receive them there than at Westminster."—"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 fell again till a truce between England and Flanders was made for the benefit of trade. This fact shews the dependence of England, even at that time, on the export of manufactured woollens. In this reign we find Lancashire and Cheshire first named as centres 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 wrought manufacture, and of all goods made with a wrought 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
WOOLLEN MANUFACTURE.

persons besides woolen manufacturers, who bought wool for
the use of, and merchants of the flaxer, 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 flaxer,
and to the rich clotheries. In the first year of the fol-
lowing 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 af-
firmed is this: That almost the whole number of poor in-
habitants 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 yard,
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 Eng-
land. He kept one hundred looms in his own house, and
in the expedition against the Scotch, he sent to Fiddlen-
field one hundred men, fully equipped, at his own expense.
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 fame have not been made elsewhere in the said county
that of late that this manufacture had spread itself into other
parts of the county, and was thereby debased and discred-
ted, 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 manu-
facturers were willing to disgrace that liberal spirit of monopoly,
which disgraces almost every page of our commercial his-
tory. 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
richers in the monopolies of the guild, to establish them-
1
selves in the western villages of the county, where provi-
sions 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 interceding account
of Halifax, in consequence of an act passed in the 26th of
Henry VIII. to prevent any other persons than merchants
of the flaxer and woolen manufacturers from buying wool
in the county of Kent and twenty-seven fairs. The poorer
manufacturers, who were unable to lay in their flock of
wool at one time, being thereby 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 walle and moors, where the fertility of
the ground is not apt to bring forth any corn nor good
grafs, but in rare places, and by exceeding and great in-
dustry of the inhabitants; and the fame inhabitants alto-
gether do live by cloth-making, and the greater part of
them neither geteth corn, nor is able to keep a horse to
carry woolys, nor yet to buy much wool at once, but hath
ever used to repair to the town of Halifax, and there have
borne two or three feme, according to their ability, and to
carry the fame to their houeses, three, four, or five miles off,
upon their heads and backs, and so to make and convert the
fame either into yarn or cloth, and to sell the fame, and to
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 reaon of the late
statute (39th of Henry VIII.) that taketh away the wool-
driver, so that they cannot now have their wool by fuch
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 woolys 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 parishes of Halifax, to buy any wool or woolly at fuch
time as the clothiers may buy the same, otherwise than by
engrossing and forefelling, so that the persons buying the
same do carry the said woolys to the town of Halifax,
and there to sell the same to fuch poor folks of that and other
parishes adjoining, as shall work the fame in cloth of yarn,
to their knowledge, and 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 fold.”

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 frames
for the erection of fulling-mills, and for other process 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 quarters for the dyeing 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 subside and aulnage of all cloth made in the county of Mon-
mouth, and in the twelve fairoes 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 craftily and
hard rolled together, that the buyer could not perceive the
untrue making thereof. These acts extend the extension
of the woollen manufactures westward.

In the fame reign, an act mentions the woollen manufac-
tures as being established in Worcestershire, but prohibits
any one from making cloth in the county, except within
the city of Worcester, and in the towns of Evesham, Droit-
wich, Kidderminster, and Bromsgrove; and fords the
owners of houses in those places from letting them at ad-
tant to prevent any other manufac-
turers. The woollen manufac-
ture has continued to the present day at the two
half of these towns. In the reign of Edward VI. Coventry
and Manchester are mentioned as manufacturing places.
The manufacturers in the old established towns of the woollen
trade appear to have been greatly alarmed at the extension
of the cloth manufacture, and have exerted all their in-
fluence to restrain it. Near the conclusion of the reign of
Philip
WOOLLEN MANUFACTURE.

Philip and Mary, an act in 53 sections was passed, relating to the making of woolen cloths. It enacted, that no person shall make woolen 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, Wiltshire, Cumberland, Northumberland, the bishopric of Durham, Cornwall, Suffolk, Kent, the town of Godalming 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, in its infancy, obviated by the titleRequest shared content.

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 Still Yard, Staple, and Adventurers.

The merchants of the Still Yard were of ancient standing, and were originally from the Hanse towns: they had great privileges granted them, and particularly they were not allowed to export and import all wares and merchandise, 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 evade the regular duties on such goods. This company had engrossed a considerable part of the cloth trade. In the year 1511 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 600,000l., and 40,000 cloths of all sorts, baizes and kerseys, worth 400,000l., 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 woolen trade alone amounted to five millions. The Latin terms which Camden employs, milliones aurorum, leaves the amount intended uncertain: if we suppose it to be dutacs, the quantity is much greater than England exported at that time; probably florins were intended, which makes the amount about 750,000l.

Besides the exports to Antwerp, English cloth was at this time sent to Amsterdam, Hamburg, Sweden, Russia, and other countries. The woolen 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 13s. 4d. to 22s. per yard; and the shilling containing the same weight of silver as our late coinage, viz. 96 grams, the relative value of a ton 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 Vol. XXXVIII.

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, in the opinion of the superior founders of the staple or fibre, and the quantity supplied, gave a decided advantage to our manufacturers of stuffs or wovilled pieces.

The perfection of the Protestant 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 wrought goods and light woolens, called bys and fays; they also introduced the manufacture of linens and flax, and it is supposed that they first taught the art of weaving on the flocking-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 woolen 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 dearth and scarcity that prevailed during this long reign, the influx of foreign makers of new kinds of woaded, 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 fakery 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 imported woollens to the amount of one million silver florins 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 enjoyed, and particularly from the prevailing table for costly dyes which has spread from the court through the country.

A great part of our woolen 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 4 N dyeing
WOOLLEN MANUFACTURE.

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 Heymer." (Obly'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 kerseys, in the white, fifty thousand cloths, counting three from a clothe, whereby had been lost about five millions to the nation in labour, profit, &c. The author informs us, that the baizes exported were dressed and dyed at Amsterdam, and shipped to Spain, Portugal, and other kingdoms, under the name of Flemish baizes, fetting their value from them; "so that we lose the very name of our home-bred commodities, and contrary to the reputation of profit thereof." The author concludes with alleging, 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 monopolies, 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 purveyor 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 great advantage 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 woolens had fallen to less than one-third of its former amount; and in the year 1622,

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>All our exports of every kind</td>
<td>amounted only to</td>
<td>2,320,436 12 10</td>
</tr>
<tr>
<td>Whilest our imports were</td>
<td></td>
<td>2,619,315 0 0</td>
</tr>
<tr>
<td>Leaving a balance against us of</td>
<td></td>
<td>298,878 7 2</td>
</tr>
</tbody>
</table>

It being from experience proved, that the policy of dressing and dyeing all our goods at home had produced the greatest injury to the woolen 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 in which they most wanted, it was the means of increasing our trade: indeed it is said by Mifselden, 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 fearfully possible that our state-men at that time could have proceeded to the prohibition of white cloth exports, unless they had been (as was asserted) influenced by prebends from alderman Cockayne and the rich merchants, who expected to receive the benefit arising from the prohibition, and the exclusive right of dressing. The wool-growers equally felt the ill effects of this prohibition. Wool is said to have fallen from thirty-three shillings per yard to twenty shillings; if by this is meant the long comber-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 tenants of the French Protellants, 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 flax were amply repaid by the introduction of manufacturers, with which they were before unacquainted. In the year 1622, king James inflicted 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 Browlowe, of Belton in Lincolnshire, sold four years' wool at twenty-four shillings per pound to a baize-maker of Colchester. As it is reasonable to suppose that this was the long combing-wool of that county, it shows 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 woolen 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 Danzig, 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 abolition 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 Polands 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 admitting it with that of their own country. It is needless to say, that
WOOLEN MANUFACTURE.

the negotiation of Sir 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 woollens were permitted to be exported. In the reign of James I. and Charles I., when the trade was declining, an act was passed 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 32. 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 seditious exportation of wool out of the kingdom, and for the better settling to work the poor people and inhabitants of the kingdom, to the intent that the full and felicitate and benefit of the principal native commodities of the kingdom may redound to and attend to the advantage and benefit of 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 Telem 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 1666, 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 progress, 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. 160. 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 better 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 Navigation Laws. It was owing to the municipal laws of England, and its usages towards strangers, who, besides being doubly rated at the custom-houses, 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 being a mystery not accounted new, though very much superior to the cloth working then known in England. It was only those who wrought on new kinds of wroughts, felts, damasks, or flockings, who went thither. The fame policy was also adopted by the Hanse towns; hence the greater part of the vall 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 1666, were so much inferior to the Dutch in the manufacture of fine cloth.

In the year 1665, 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 weft of Spanish wool. The best Spanish wool was then 4l. and the second sort 32. per pound, and the best English 1s. 6d. per pound. It is deferring of notice, that, in the latter period of the commonwealth, our trade was said to have been 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 Thurlow'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 abstated 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 fluffs 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 23. 2s. per pound, and English at 6s. per pound. The writer attributes 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 moiety angular 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 the same, 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
WOOLLEN MANUFACTURE.

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 woolls 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-faftures. 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 flate, exposed it to confiscation. About the year 1640 some clothiers from the west of England established a woolen 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 Kinsale; a few French manufacturers of druggists 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 woolen 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 fleece 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 suppos’d to be below what it was a few years afterwards. If the number of sheep were calculated on the average weight 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 woolen 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, "beleaching 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Stone of Wool</th>
<th>Stone of Yarn</th>
<th>Total of Wool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>336,292</td>
<td>26,617</td>
<td>362,909</td>
</tr>
<tr>
<td>1701</td>
<td>300,812</td>
<td>23,390</td>
<td>324,202</td>
</tr>
<tr>
<td>1702</td>
<td>315,473</td>
<td>43,848</td>
<td>359,121</td>
</tr>
<tr>
<td>1703</td>
<td>300,802</td>
<td>36,873</td>
<td>337,675</td>
</tr>
</tbody>
</table>

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 much 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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Wool</th>
<th>Yarn</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1711</td>
<td>310,136</td>
<td>52,273</td>
<td>362,409</td>
</tr>
<tr>
<td>1712</td>
<td>263,946</td>
<td>66,108</td>
<td>324,054</td>
</tr>
<tr>
<td>1713</td>
<td>171,871</td>
<td>68,548</td>
<td>240,419</td>
</tr>
<tr>
<td>1714</td>
<td>147,153</td>
<td>58,147</td>
<td>205,300</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Wool</th>
<th>Yarn</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1726</td>
<td>14,321</td>
<td>26,261</td>
<td>138,362</td>
</tr>
<tr>
<td>1727</td>
<td>58,187</td>
<td>72,047</td>
<td>130,234</td>
</tr>
<tr>
<td>1728</td>
<td>49,784</td>
<td>80,448</td>
<td>130,232</td>
</tr>
<tr>
<td>1729</td>
<td>38,667</td>
<td>91,854</td>
<td>130,521</td>
</tr>
</tbody>
</table>

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 coat. It would be seen subequently, that the woolen 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, suppos’d to have been published about the year 1667, we learn several important particulars respecting the woolen trade. "Though our vent for fine cloths and stuffs to Turkey, Italy, Spain, and Portugal, were, be 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 sell 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 goodnes of it, as most notoriously appears in the bufnifs of alwag, which doubtles our predeceffors intended for a ferunity into the goodnes of the cloth; and to that purpose a seal was invened as a signal, that the commodity was made according to the statute; which seal, if it is sold, may now be bought by thousand, and put upon what the buyers pleasfe. 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 (perfection) 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 that can give the beet price for a commodity shall never fail to have it by one means or another, notwithstanding the opposition"
WOOLLEN MANUFACTURE.

opposition of any laws by sea or land; of such, force, sub-
tility, 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 im-
policy of the numerous restrictions by which the manu-
facturers were obliged to make cloths of certain weights
and lengths, to keep only a certain quantity of looms,
or to prohibit dyers, fullerers, &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
sizes."

One of the principal causes of the decay of our woollen
manufactures, for Joshua Child might not think it prudent
to flate. This was the encouragement given to the con-
fumption 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 admi-
nistration 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 in the home.
In 1750, 1769, and 1776, acts were passed, the 29th and 40th
of Charles II., prohibiting the importation of French com-
modities for three years. From this time trade began gra-
dually to revive, and would have greatly increafed, 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 con-
fumption 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.:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>The annual income of England, of which the people subsist</td>
<td>£ 43,000,000</td>
</tr>
<tr>
<td>Yearly rent of land</td>
<td>£ 10,000,000</td>
</tr>
<tr>
<td>Value of wool yearly shorn</td>
<td>£ 2,000,000</td>
</tr>
<tr>
<td>Woollen manufacture of England</td>
<td>£ 8,000,000</td>
</tr>
<tr>
<td>Woollen manufactures exported</td>
<td>£ 2,000,000</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Year</th>
<th>Value of Woollens Exported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1718</td>
<td>£ 2,073,696</td>
</tr>
<tr>
<td>1719</td>
<td>£ 2,730,257</td>
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<tr>
<td>1720</td>
<td>£ 3,659,049</td>
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<tr>
<td>1721</td>
<td>£ 4,925,310</td>
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<tr>
<td>1722</td>
<td>£ 5,384,942</td>
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About the year 1722, the plague at Marlesfle, by prevent-
ing the exportation of French woollens, increased the de-
mand for English manufactures considerably. In the year
1737, the woollen exports amounted to £ 4,158,435; 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 £ 4,180,195

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 quan-
tity of long combing-wools grown in England had
been given to the manufacturers of worsted goods a decided ad-
vantage 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 flown. The demand for worsted
goods at home, for tammies and stuffs, which were the gen-
eral drefs 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 Por-
tugal, for the use of their South American colonies, and
for the dreeses 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 trade, pro-
duced a great change in the article of female dreses in
England, stuffs and tammies being supplantated by cotton goods,
which became 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 tole of 28lbs. of the best Lincoln-
hire wool for combing was not worth more than nine
shillings, and the inferior kinds six shillings, or about three-
pen 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 proce-
ses of manufacture, either in woolen 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 gra-
dually concentrating into Yorkshire and Lancashire, where
the cheapness of living, the active industry of the inhabit-
ants, 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,
showing the amount of broad and narrow cloths made in
the Weft 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-five thousand
nine hundred. At present our woollen exports are not 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 in-
clude the cloth manufactured in Lancahire, and the borders
of Cheshire adjoining Yorkshire, nor the blankets, ferges,
bazins, flannelles, cahiferes, toulines, carpets, rugs, worsted
goods, or any other description of wool in the cotton trade,
except plain and narrow broad cloths. The total amount
of these different woolen 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, 1726, (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.

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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 altertied in the speech of Mr. Law, now lord Ellenborough, in the house of lords, as council 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 apprehension of the population of the West Riding of Yorkshire is nearly ascertained, and perhaps two-thirds of the who 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 woolen manufacturers in Cheshire and Lancashire, we shall certainly not under-rate them. A large part of the West Riding being agriculturally solely, and in the manufacturing districts cutely, as at Sheffield, and cottons in the more western parts, employ no considerable portion of the people. If we then take 340,000 as the amount of persons, with their families, engaged in the woolen 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 woolen 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 masters 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 feats of the woollen trade. For several years afterwards the effects were felt in the manufacturing districts in the west of England, and great districts 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 Wilts, all ancient feats 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,

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<th>Quantity of Napped Coatings, Duffles, &amp;c.</th>
<th>Quantity of Caffinieres</th>
<th>Quantity of Bales of all Sorts</th>
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<td>Quantity</td>
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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.

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Vol. XXXVIII.
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 Continent scarcely exceeds three millions featuring 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 increased 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; and to which the people of England are better drest 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 Welf 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 relied, were partly the preference given to the Irish, and partly the supposition 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 manufactories 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 principally 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 export 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 manufactories were in a very declining state, which proves at present 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 woofs 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, their woofs 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 flatuit law of the land, he is confined to its use 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 woolen 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 fell his goods, when manufactured at a reasonable profit, infurs to the owner of land a moral certainty of obtaining the full value of 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 decrease in the woolen 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
WOOLLEN MANUFACTURE.

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.

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1786 - - - - 0 13 o
1787 - - - - 0 17 o
1788 - - - - 0 17 o
1789 - - - - 0 18 o
1790 - - - - 0 18 o
1791 - - - - 0 19 o
1792 - - - - 1 2 o
1793 - - - - 0 18 o
1794 - - - - 0 17 o
1795 - - - - 0 19 o
1796 - - - - 1 1 o
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1799 - - - - 1 1 o
1800 - - - - 1 4 o
1801 - - - - 1 0 o
1802 - - - - 1 0 o
1803 - - - - 1 9 o
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1805 - - - - 1 13 o
1806 - - - - 1 12 o
1807 - - - - 1 4 o
1808 - - - - 1 4 o
1809 - - - - 1 8 o
1810 - - - - 1 10 o
1811 - - - - 1 5 o
1812 - - - - 1 10 o
1813 - - - - 1 14 o
1814 - 2 2 o to 2 12 o
1815 - - - - 2 10 o
1816 - - - - 1 10 o
1817 - 1 14 o to 2 0 o

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 subsequente 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 affect, that our native clothing fleeces are necessary to the foreign manufacturers, 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.

4 O 2
WOOLLEN-MANUFACTURE.

WOOLLEN Manufacture, Proces of. In an early part of this work, under the article CLOTH, we have given a general view of the processes 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 claffed 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 processes 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 flapes; 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 uncoured; 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 expense; but this is more than counter-balanced by the increased quantity of oil per pack required for uncoured 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 proces 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 suppos'd to be sent, is principally used; and for coarse cloths rape-oil. Where attention to colour is not required in very coarse goods, giff-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 leffen the expense of oil for coarse cloths, some manufacturers in Yorkshire make use of a mixture of soap and water with oil, which anwers 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 fibrilling. This process is a kind of coarse carding, and is performed on a machine similar to that used for fibrilling cotton, but larger, and with coarser cards, the principle being similar to that of the carding-machine, last 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 fibrilling-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 twirl round each other in the next processes, which is a kind of coarse spinning called flubbing, performed with the flubbing-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 flubbing. These flubbings being taken to the spinning jenny, which will also be described, are twirled in an opposite direction, and drawn out into threads of yarn of the requisite length. For very fine yarn used in flawns, a machine called the mule is sometimes employed, nearly similar to the cotton mule (see Manufacture of Cotton), the filling passing through rollers which spin in drawing out the thread smaller and more regular. The yarn is now prepared for winding, fascing, 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 proces is looping 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 processes of fulling, the cloth becomes shortened in length and breadth, and the fibres are incorporated and intimately united with each other. In the felt 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 processes, the face or surface of the cloth is much softer, and greatly superior in appearance to cloth manufactured in the common processes. 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, bearding, and pruffling, have been mentioned under the article CLOTH, and will be more fully described when an account is given of the gig-mill and bearding-machine. The object of these processes is to cover the cloth with a soft pile, conflicting 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 flatter and heavier than coarse ones; they are both scoured in the mill, but are scarcely suffered to undergo the falling 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 cloth is divided equally 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 caissifemes, on the contrary, the warp is unequally divided, to produce what is called the twill, or twist. (See WEAVING.) The three-fourths of the warp lie above and two-thirds below the shuttle as it passes. It is owing to this arrangement of the warp, that it forms a flaxing or diagonal rib across the body of the cloth, which is the distinguishing character of this kind of woolens. See ДRAUGHT of LOOM.

Caissifemes are usually felt 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 thirty yards of common milled fine caissifemes; the double milled ones make less in proportion to the degree of milling they receive.

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

Serges are made with the warp of worsted and the weft of coarse woolen yarn, and are twilled. Thee 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 woolen wefts. See CARPET-WEAVING.

From the most remote period of the woolen 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 been 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 woolen 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 hand, and the fluffing 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 flight change in the construction of the machine was found necessary to prepare the wool for the fluffing-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 fibrilling machines were turned by a water-wheel, and the roving or fluffing performed on the billy. The wool carded at these mills was sent to the smaller manufacturers in the state of fluffing, and the further process of spinning was effected on jennies in their own premises. Before the year 1787, the old process of carding by 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 woolen trade became more concentrated in Yorkshire, where cloths could be manufactured at less expense. 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 woolen 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 woolen trade, and performing all the processes with their own machinery, they were enabled to work cheaper and underfell 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 refinance made to them by the working cloth-drovers or croppers in the north.

The manufacture of worsted is properly a branch of the woolen 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 finnishing 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.—In the wool-mill, or mill, is the sift machine which is employed on the raw wool to open and disentangle the fleece matting, in which the wool comes from the wool-rappler. 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 interlock each other when they all turn round; and the teeth of the five small rollers also interlock each other. The cylinder and rollers are inclosed in a box or cafe, 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 effect 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 cafe 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 cafe; 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 full of projecting wire-teeth, called card-wires. The teeth are close together so 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 from 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 combes 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 continuous 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 laid to be carded, but the fibres are not yet sufficiently combed out or separated; for on examination of the carded wool, many small knots and films of wool are found, which are still closely entangled. The carding 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 carding-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 bell machines have cast-iron frames; C C is the outside of the large cylinder, which is about thirty inches diameter, and twenty by 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 ferews, which support the fixed 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 T. This pulley is turned by an endless cord passing round a pulley S, fixed upon the cog-wheel E, which is turned by a pinion P on the end of the axis of the great cylinder. The wool which is spread upon 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 2\frac{1}{4} 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 the plate is worked with a cylinder 9, 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 flipping; the chain passes beneath a wheel fixed on the axis of the cog-wheel E, but within side 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 times of the great cylinder, and the workers being about 65 inches diameter, whilst the cylinder is 30 inches diameter, the surface of the cylinder moves about 1 3/4 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 roller 1 passes over a wheel of about 8 1/2 inches diameter, fixed on the extremity of the axis of each clearer; this roller 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 2 1/2 times to one of the great cylinder; but as they are only 3 3/4 inches diameter, and the great cylinder is 30 inches diameter, the surface of the cylinder moves near 3 1/2 times as fast as that of the clearer. The carrier 4, a is turned by the same roller 13 1, 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 roller 13 a 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 4 1/2 inches diameter, and the fly itself nine inches. The fly is not placed 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. This doffer moves round very slowly, its surface moving only 1/3 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 flaps 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 fixed on an horizontal axis, which is situated at the lower part of the frame near the ground, and put in rapid motion by a flap, 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 flap 15, 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 drop off the wool, and so on: hence the wool is drawn off from the machine in a carded flake, 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 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, and 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, 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 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 dropped 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 shown 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 crofs, marked 16, 16, fixed on the end of its axis; the arms of the crofs are seized by a cranked lever, 15, which is fixed to the axis of the roller-bowl, and at every revolution the crofs 16 is turned round once: this moves the endless cloth forwards, and carries the cardings away in the manner shown at 7 7 7, as fast as they drop out from the shell, and from this table they are carried away to the flubbing-machine, or billy.

In most modern machines the latter movement is altered, the endless cloth being kept in a continual and flow motion by an endless band pulling round a small pulley fixed to the pulley H, and a larger pulley fixed in place of the crofs 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 flaps, 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 wood-diks but are not 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 filz of wool which is taken off is continuous, and is suffered to fall down into a balecket.

Double Scribblers.—In Yorkshire it is common to employ double scribblers; 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 doffers, 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 feed-cloth; it therefore has no comb. The doffer of the second cylinder has a comb to take off the wool, which then falls into a balecket.

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 form 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.

Scribbling-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 flibbing 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 flubbings 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 flibbing-machine, now universally employed, is given in Plate 1. Wollen Manufacture. A A is the wood frame of the machine; within this frame is a moveable carriage, D D, which runs upon the lower idle 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 pulls 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 flibbing, 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 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 flibbing.

The cardings of wool, which are to be spun into flubbings, 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 an earring 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 raising: but when it falls by its weight, it holds the cardings fall between the two, and hence these rails are called the clap; the upper moveable rail G of the clap is guided between sliders, and a wire g descends from it to a lever 6. When the carriage D is wheeled close home to the end of the machine, a wheel h lifts up the end 6 of the lever; and this, by the wire g, raises the upper rail G fo as to open the clap, and release all the cardings: in this state, if the carriage is wheeled or withdrawn back from the clap, it will draw the cardings forward. There is a small catch which receives the upper rail G of the clap, 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 clap 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 clap 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 coaré thread or flibbing which is thus produced.

The flibbing is lapped round the spindle, but the clap being higher than the upper ends of the spindles, the direction of the flibbing is not quite at right angles to the spindle; hence the flibbing, when it is turned round, will give twist to the flibbing, without winding or gathering it up.
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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 prefixed 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 defends below the level of the top of the spindles, so as to bear down the threads which, when the wire is raised up, as shown in the figure, proceed from the points of the spindles.

The spindle 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 shown in the figure.

As the cards 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 cards. 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 shown in the drawing, it has a weight fulspended 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 endels cloth round in a direction to deliver out the cardings, so that there will be no flaw 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 feeds 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 endels 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 endels 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 fall 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 twirls 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 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 direction 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 twitted 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 into fine yarn.

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, 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.

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The spindles 3, 3, 3, are placed perpendicularly at about four inches farther at one end of the frame A A 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 in a direction parallel to the row of spindles, it turns them all round by a small band for each. This cylinder is usuall 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 weft or band 1, 1, which passes round a pulley at the end of it, and also round the great wheel B, which is supported in a framing fulspended over the machine from the ceiling, but which is not shown in the drawing. The wheel B is turned by applying the right-hand to the flinch B. In front of the row of spindles, and about a foot higher than their point, the jenny 16 is situated horizontally; it is supported at each extremity by being mortised into blocks of wood 5, 5, which are furnished
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with small wheels or axlers, forming a form 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 under side of the rail 16 is formed into a number of narrow notches for the flubbings to pass through; and these notches are partly filled up by projecting pieces, rising up from a second cross-rail 4, 4, so as to form the claps which confines or pinches the flubbings in the notches when the lower rail is raised up; but the flubbings 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 claps. 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 claps. 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 the rail can raise up the lower rail 5 of the claps, 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 flubbings fast in the notches, through which they pass; but when the spring-catch is pushed back, so as to release the handle, the lower rail will fall down by its own weight, and release the flubbings, to allow them to slide through the notches.

The cops of flubbings 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 shown in the drawing; but each row should only contain half as many cops as there are spindles.

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

When the yarns have been drawn out and twirled 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 6, 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 furnished from the wheel 13, 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 the 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 claps in the left, so as to run it backwards and forwards along the frame at pleasure. The flubbings are drawn between the moveable rails 16 and 5, in the notches of the claps, and each flubbing is fastened on to its corresponding spindle. The claps being left open is drawn backwards from the spindles, and the flubbings run freely through the notches of the claps; the flubbings are drawn off the balls at 4, when the claps retire from the spindles, until a certain length of each flubbing is drawn out and extended nearly in an horizontal position between the spindles and the claps; this length is regulated by a mark made on the frame of the machine, to indicate when the clamp has arrived at its proper position. The bars of the claps are then brought together by raising up the handle under the catch, as before described, and it fastens all the flubbings in the notches. This being done, the spindles are put in rapid motion by turning round the large wheel B; they twist the parts of the flubbings which are extended, and the motion being in a contrary direction to the twist of the flubbing, the first tendency is to untwist the flubbing, at the same time that the carriage and claps are gently drawn back, or from the spindles. By this means, the flubbings 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 flaps 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 claps 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 flubbing, 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 flubbings in balls upon the spindles, at the same time that the carriage and claps are pushed back towards the spindles. When the carriage is got home, the thread is finished and wound up, and a fresh portion of flubbing is extended. To do this, the lower rail of the claps is dropped down, and it releases the flubbings; the carriage is then drawn back to the mark upon the frame, as before described, which shows that a proper length of each flubbing is drawn off from the balls, and extended between the spindles and the claps. The claps is then closed, and the wheel B put in motion to twirl 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 direction 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 flubbing; for the principal extension of the thread is effected whilst the flubbing 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 flubbings 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 moved over the whole length of 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 shunts 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 quickly 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 coppons 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 fliver like cotton, with the fibres stretched the lengthways of the fliver, is formed into separate rolls, with the fibres dippedf with the crufiwife or spirally round the roll.

By the flubbings-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 this 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 fliver to a smaller size, because as many times as the fliver is extended in length, so many flivers are put together into the drawing-frame at once, leaving the fliver 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 defirable 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 preferred, 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 flubbings 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 coppons of yarn are mounted on wire 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, 2060 threads, each 65 yards long, are laid parallel to each other; but a separation is preferred 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 coppons, 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 flider, 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 flels 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 caustic 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 105½ 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 twenty-five yards of yarn will make only thirty-two yards of cloth.

Scouring.—The piece of cloth must be cleansed from the greasy oil that clothes it 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 frocks. (See Fulling-Mill.) The pair of frocks are two large wooden hammer, suspended with the handles or 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 hammer, they fall by their own weight, and strike the piece of cloth, which is contained in a wooden cleft 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 cleft 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 beats 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 frocks 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 poles 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 poles, 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 poles, according to the width of the piece of cloth. Both the upper and lower horizontal 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 burling, that is examined minutely in every part, and all knots and uneven threads or flaws, 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 frocks in a fulling-mill; but the shape of the trough in which the frocks 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 subserve 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 beats of the hammers is nearly at a flat surface, and perpendicular to the direction in which the hammers strike, so that the cloth is actually beaten between the beams 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 heads or handles of the hammers are placed in a different position from the scouring-frocks, 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 fulling-frocks, while those used for scouring are called hanging-frocks, in which the heels 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-frocks only drive the heap of cloth round in the trough, there being no part directly opposed to the beams 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-frocks, 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 helves are suspended in a vertical position, like pendulums, and the force of the helves 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 frocks. This lever and chains draw back one hammer when the other is pulled forwards; and as the hammers are actuated alternately by the helves, 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 pairs 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 9½ 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 the four hammers forming two pairs of stocks. The same mill was adapted to be turned by the power of horsey 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 horsey turned. The levers by which the horsey drew were 15 feet long, so that the horsey’s track was 30 feet diameter.

It required four horsey 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 over-shot-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 horsey at 352 cubic feet per minute raised one foot, this is very nearly equal to four horsey. These stocks were used for fulling of bays, and we apprehend the power for working the fulling-mills for broad-cloth is greater.

Procédé de 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 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 foamed 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. Manzoni, 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 polar microscope, are terminated by even lines, without any roughness. Nevertheless it is probable the surfaces of these objects are formed either of lamelle, 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 writh 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 writh, sometimes against the skin, takes a progressive motion backwards, but the beards always move in the opposite direction to its return, so that it then gets up to the arm. It is evident, therefore, 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 flalk. 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 reinact 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 theef is, therefore, to be considered as composed of hard lamelle placed one upon another, like tiles, from the root to the point; which lamelle 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 fcin, 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 foros from the application of wool does not proceed to 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 every thing which, besides giving it a disagreeable smell, would cause it to foul 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 of it 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 prelure given by the hammers to the piece of cloth, especially when theilling is very 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 woof, 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 woof are no longer so distinct and separated from each other as to leave interstices between them, the cloth forms a warmer clothing, independently of its having acquired a greater degree of thickness. Knit work is also rendered less apt to run, in cafe a flitch should drop, by the operation of fulling.

Tentering.—When theilling 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 holds all the useful qualities of the.

Dressing the Cloth with Teasels.—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 teasels, in order to form a wool on the surface, which can be removed by shearing. The teasels are the balls or ears which contain the seeds of the plant called diplocus fallonum; the scales which form the ball project on all sides, and are terminated with sharp points, which turn downwards, like the hooks, and are very elastic. See Teasel.

A number of teasels are put into a small frame, which is composed of a handle eight or ten inches long, having a small flick 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 flick, which is passed through the handle near the middle of its length; the two split flicks are perpendicular to the item or handle, and parallel to each other. The space between them is filled with teasels, which are jambed in very fast between them, and also in the clefts of the split flicks, where they are secured by string extended between the ends of the split flicks, and twisted, until they draw the flicks forcibly together, and bind the teasels very fast. This frame filled with teasels 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 teasel-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 flate, 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 teasels, and turned rapidly round whilst the cloth is drawn over it.

The Gig-mill is represented in perspective in Plate V.

Woollen Manufacturer. M is the wood frame of the machine; F F is the cylinder or drum, which is composed of 12 rails or troughs, filled with teasels F F, 3 4 E E. 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 E D at one end of its axis, which receives an end-lefs 3, 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 loofeely, with liberty to turn round freely upon it; the frap 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, F F, covered with teasels, is mounted on bearings supported by the frame, and the piece of cloth G is conducted over it, to receive the action of the teasels; 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 O, fixed on the extremity of the axis of the drum C; this turns a wheel H upon an inclined axis, which has a pinion at each end; one of these pinions, Q, turns a bevelled wheel, K, on the end of the axe of the upper roller.
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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 teals, like those we have before described, are fastened in a very simple manner; and the frames are placed to close together, so that the trough is wholly filled, and forms a continuous surface of teals to act upon the cloth when the cylinder revolves. When the hooks of the teasel are 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 fleec comb.

The teasel is 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 teasel. Mr. Price of Stroud, in Gloucestershire, has two patents, dated 1807 and 1817, for this object; Mr. Laffaire of Britoil took a patent in 1816, Mr. Williams of Furnley in 1817, and Melridge Lewis of Brincomb in 1817. We are not informed if any of these inventions are yet brought into real use in the manufacturing trade.

Shoeing or Crocking the Cloth.—By the operation of the teasel, 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 cloth is sheared, consisting of two very large flat blades or 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 scissors, 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 shown 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 shown 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 cropping, will stand up above 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 shown 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 cropping, will stand up above 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 shown 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 cropping, will stand up above 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 shown 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 cropping, will stand up above 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 shown in the figure.

It is an advantage of this method, that the cloth, in deflending from the ceiling, hangs perpendicularly, and with that side which has been dreeled 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 dreeled, he 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.
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The other end of the cord is fastened to a block of wood, which is ferrowed to the flat of the lower blade, and rives up to a proper height. By deprefing 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 fluffed 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 frames 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 lathed to the bow of cloth, and the two shears are fastened to the staff by a string; 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 clotes 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 cloths in 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 shearsers 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 florn, 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 fame 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 floor 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 floor, 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 flopped, 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 1785, 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. Woolen Manufacture; it is used in the weft 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 ferrowed; immediately beneath this blade is the cushion to bear the cloth, which presses 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 flowly 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, upon which the bearing of the spindle is ferrowed; 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 Z, 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 flowly round. The three pulleys on the spindles 3 and J are placed revered to each other, that is, the smallest pulley on one is opposite to the largest on the other; by this means, the fame strap Z 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 from each other. The cunions which bear upon 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 pressire 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 work in succession over the same surface, they cut the cloth twice over in passing once through the machine. It has been attempted to sheaf 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 evenly over the shears, so 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 sheared 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 sidewise 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 1820, 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 scissors-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 interefect 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 thorn 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 disperse all the water imbibed from the steam.

Rotary 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 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 face to cut against the edge of the fixed blade, the following revolving blade will begin its action at the other end of the cylinder; and, by the time that any one of the revolving edges has passed over 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 slaps 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 slaps are so fitted into grooves or troughs, that they are firmly retained to move straight forward in their oblique direction; and the direction of the obliquity is such, that the
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hands 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 cloth, (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 while it is cut is only a narrow ridge of metal, over which it passes, so as to be bent with a sudden curve, 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 wear 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 movable 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.

Fringing 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 practiced 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 fringing 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 flow 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 table, is covered with an artificial flake, 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.

Bruffing.—After being frized 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 yflet 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.

Prffing.—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-pref; 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 pref contains a proper quantity, the screw is forced down to give a very severe pressure to the pack. The cloth remains in the pref 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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pref inexhaustible 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 lightly warmed, and the cloth has but little glows given to it. The glazed paper is a thick kind of cardboard, 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 glosa 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 process 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 goods 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 this 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 Wiltsire 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; 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-
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 artisans 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 tiffue 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 sub stance, 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 expenses 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 combing-wool is described in the article Worsted.
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SPINNING JENNY.