COTTON.

Cotton, in Commerce, the soft and beautiful vegetable down which forms the covering or envelope of the seeds of the gossypium or cotton plant. It is the spontaneous production of three parts of the earth, and is found growing naturally in all the tropical regions of Asia, Africa, and America, whence it has been transplanted and become an object of cultivation in the southern parts of Europe.

It is brought to us from the West India islands, the Spanish, Dutch, and Portugese settlements on the coast of South America, and the isles of Bourbon and Mauritius in the East Indies. Georgia, and the southern latitudes of North America, also annually produce great and increasing quantities. The islands and shores of the Mediterranean have long supplied Europe, and within these few years, the privileged merchants of India have brought hither considerable quantities from Surat, Madras, and Bengal.

The cotton from these different quarters of the globe varies considerably in the colour, length, fineness, and strength of its fibre. It is the produce of several species and varieties of the gossypium, and without wholly adopting the hypothesis of Quatremere Dijouval, we may admit that difference of climate has considerable influence on the texture and quality of the cotton.

According to the observations of that gentleman, crowned by the Academy of Sciences of Paris, the produce of the countries immediately under, or near the equator, is to be considered as the type of excellence, and is distinguished by its fine silky fibre, the depth and peculiarity of its colour, and the height and permanency of the plant. In proportion as we recede from the equator, says our author, these strong marked characters disappear, the fibre becomes coarser, its colour perfect white, and on the shores of the Mediterranean, we behold the lofty and flourishing cotton tree of Hindoostan, dwindled down into a flinty annual shrub.

The exceptions to this system, from a comparison of the cotton of South America and the West Indies, with that of India and the Levant, are repelled by M. Quatremere Dijouval with some ingenuity, but his observations and reasonings are too general; and we shall presently see that this system of gradation in size, colour, and fineness, from the equator to the poles, has no existence in nature, and is disproved by the characters we shall adduce of the principal varieties of cotton at present known in commerce.

It is true, that the finest cotton we have any knowledge of, is the produce of the tropical countries, as well as the deepest coloured. The delicate and unrivalled fabrics of the East, and the genuine nankeens of India and China, afford a proof of this. Yet the cotton from which they are produced, is retained at home to supply the native manufactures of the country, and is wholly unknown in commerce. The cotton of Bengal, Madras, and Surat, such as is brought in quantities to Europe, is scarcely tinged with yellow; and Siam, famous for its nankeen, is equally so for its fine white cotton, which has long been transplanted to the West Indies. The sea-coast of Georgia, and its dependant isles, though situated in latitude 33° north, ten degrees beyond the tropic, produces cotton superior in quality to the colonists of Guiana directly under the equator, whilst the inland districts of that province, and the country south of it, down to the mouth of the Missisippi, produce a cotton of greater whiteness, and far inferior in strength and fineness.

Cotton is distinguished in commerce by its colour, the length of its fibre, and its strength and fineness.

White is in general considered as characteristic of secondary quality,
COTTON.

quality. The cotton of Smyrna, Cyprus, Salonica, and all parts of the Levant, is distinguished by its want of colour. The chief part of that from North America is also white, viz., New Orleans, Tenneflee, and Upland Georgia.

Yellow is, when not the effect of accidental wetting, or inclement weather, indicative of greater fineness. The cotton of the West Indies and of South America is called yellow, but the colour inclines more or less to cream colour. That from India has a slight tinge of Aurora. The fine Sea Island Georgia, though not properly a yellow cotton, has a faint but decided tinge, which distinguishes it from the white cotton of the same country.

In the following list are enumerated the chief, and nearly all the varieties of cotton used in this kingdom, with short notices of their quality and value.

North American Cotton.

Sea Island Georgia—used for the produce of Georgia, and the small islands contiguous and belonging to it. It has a long and fine staple, but more or less silky, flavoured or dirty, on which account no other cotton varies so much in price. The best is preferred now to every other kind, and is often sold at very high prices to the manufacturers of lace.

Upland, or Bowed Georgia—is the produce of the inland districts, and either from the nature of the soil, or defective cultivation, is much inferior to the preceding. It is a light, flimsy cotton, of weak, and very unequal staple, having long and short fibres intermixed. It is used chiefly for inferior goods. It derives its name of Bowed Georgia from an instrument like a bow, which the planters use in cleaning it.

Tennflee—much like Bowed Georgia, but in general cleaner, and sometimes better staple.

New Orleans—this also resembles Bowed Georgia, but it is generally preferred both to that and Tennflee. The fibre of these three kinds is weak, compared with that of West India, or Sea Island, and goods manufactured from it, are unable to endure the same hardship.

South American Cotton.

Pernambuco—fine, long staple; clean and pretty uniform in quality; much esteemed; principally used by the hatters.

Maranham—rather inferior to Pernambuco; not so even in quality, nor so clean; much like good Demarara, and used for some of the same purposes.

Bahia—much like Maranham; sometimes it has the advantage.

Rio—a very inferior cotton; very brown; much shell in it; used generally for the same purposes as low West India.

Surinam—has a long staple; clean; yellow; it is a fine cotton, and much used for making stockings.

Demarara—the quality of this cotton has fallen off since the colony has been in possession of the English. The belt has a fine silky strong staple, much esteemed. The inferior sorts are rather brown, dirty, coarse, and much mixed.

Berbice—the quality of this has of late years fallen off. The belt has a good staple, fine, silky, and clean; but latterly is brown, dirty, and mixed.

Carricena—has a very long staple, but weak; it is very Arinny, and rather dirty.

Giron—a brown, coloured cotton, fair staple, and generally pretty clean.

Cariona—inferior to Giron, and not so clean.

Carracca—inferior to Giron; still more dirty.

Iapira—inferior to Cumena, but preferable to Carracca; not so dirty.

West India Cotton.

Bahama—cotton from the Bahama islands is of various qualities. The best is grown from Bourbon seed, but is much inferior to that. The staple is pretty good, fine and silky, but it is often dirty. The inferior Bahamas are very brown and dirty. The staple rather short but strong, Barbadense—is of fair middle quality, the staple not very long, but generally silky, and pretty strong; often a good deal of the shell of the seed in it, which is a great objection.

Jamaica—very little cotton grown here, and that of very inferior quality; there is the long staple, which is very weak, and very often dirty, and the short, which is also very poor and dirty.

St. Kitts—very little grown; it is in general very brown, dirty, but of fair staple.

St. Lucia—the same.

St. Thomas—the same.

St. Domingo—sometimes very clean good cotton, and likewise very inferior; not much comes here.

Carriacou—rather a coarse grain, but in general clean, fair, strong staple, used by the hatters to mix with fine cotton, such as Pernambuco.

Grenada—a good deal like Carriacou, but not always so clean.

St. Vincent's—rather high-coloured; clean, good staple, but not very fine; a good deal cultivated for the size of the island.

Antigua—very little grown, much like St. Kitt's.

Tortola, Montserrat, Dominica—the same.

Martinique—very little comes here. It is a fair middle quality.

Guadaloupe—much the same, sometimes very good cotton.

Trinidad—little grown, sometimes very fair good cotton.

Trinidad—rather short staple, and in general very dirty.

East India Cotton.

Bourbon—the most even and uniform in quality of any other. It is a fine silky staple, and very clean. It is the most valuable cotton brought hither, except the best Sea Island.

Surat—has a fine, but exceedingly short fibre, in general dirty, containing leaf and sand. It is the lowest priced cotton in the market, and used in the manufacture of low coarse goods.

Bengal—much like Surat, but still shorter staple, in general cleaner, and much about the same value.

Madras—not much brought hither. It is mostly from Bourbon seed, and sometimes not unlike in staple, but in general dirty, and contains much shell, which renders it less valuable; worth little more than Surat; some very good will fetch the price of West India.

Turkey.

Smyrna, &c.—a short moony kind, and rather dirty, used for making candlewicks; has more substance than Bowed Georgia.

The preceding observations are intended to give general ideas of the comparative value and qualities of the different kinds enumerated, rather than precise and accurate descriptions, which, from various causes, such as unfavourable seasons,
COTTON.

Importation of Cotton into London.

<table>
<thead>
<tr>
<th>Country</th>
<th>1798</th>
<th>1799</th>
<th>1805</th>
<th>1806</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburgh, Tonningien, &amp;c.</td>
<td>7327</td>
<td>11208</td>
<td>514</td>
<td>137</td>
</tr>
<tr>
<td>Lisbon</td>
<td>7661</td>
<td>17818</td>
<td>3020</td>
<td>7281</td>
</tr>
<tr>
<td>Oporto</td>
<td>1095</td>
<td>2583</td>
<td>1373</td>
<td>1095</td>
</tr>
<tr>
<td>Gibraltar and Mediterranean</td>
<td>2748</td>
<td>752</td>
<td>1234</td>
<td>218</td>
</tr>
<tr>
<td>Charlestown and South Carolina</td>
<td>3079</td>
<td>3981</td>
<td>2113</td>
<td>3911</td>
</tr>
<tr>
<td>Philadelphia, Maryland, New York, &amp;c.</td>
<td>2084</td>
<td>5172</td>
<td>469</td>
<td>1035</td>
</tr>
<tr>
<td>New Providence</td>
<td>1489</td>
<td>1911</td>
<td>1712</td>
<td></td>
</tr>
<tr>
<td>Savannah</td>
<td>1221</td>
<td>1514</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Smyrna</td>
<td>600</td>
<td>1208</td>
<td>54</td>
<td>1360</td>
</tr>
<tr>
<td>Guernsey</td>
<td>531</td>
<td>162</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Jamaica</td>
<td>612</td>
<td>5005</td>
<td>366</td>
<td>639</td>
</tr>
<tr>
<td>Montserrat, St. Kitt's</td>
<td>729</td>
<td>1383</td>
<td>793</td>
<td>2375</td>
</tr>
<tr>
<td>Bahamas</td>
<td>405</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grenada</td>
<td>2122</td>
<td>846</td>
<td>1577</td>
<td>2632</td>
</tr>
<tr>
<td>St. Domingo</td>
<td>690</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbadoes</td>
<td>1911</td>
<td>686</td>
<td>1362</td>
<td>792</td>
</tr>
<tr>
<td>Antigua, St. Vincent's, and Tobago</td>
<td>526</td>
<td>381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demarara</td>
<td>2581</td>
<td>3540</td>
<td>5294</td>
<td>4920</td>
</tr>
<tr>
<td>Martinique and Tortola</td>
<td>632</td>
<td>802</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominica</td>
<td>783</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surinam</td>
<td>72</td>
<td>448</td>
<td>5040</td>
<td>1375</td>
</tr>
<tr>
<td>Copenhagen and Baltic</td>
<td>2020</td>
<td>601</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbice</td>
<td>192</td>
<td>2467</td>
<td>1458</td>
<td></td>
</tr>
</tbody>
</table>

36918 60903 29093 31606

Importation of Cotton into Great Britain.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781</td>
<td>5101920</td>
</tr>
<tr>
<td>1782</td>
<td>11206810</td>
</tr>
<tr>
<td>1783</td>
<td>9544179</td>
</tr>
<tr>
<td>1784</td>
<td>11280243</td>
</tr>
<tr>
<td>1785</td>
<td>17992888</td>
</tr>
<tr>
<td>1786</td>
<td>19151867</td>
</tr>
<tr>
<td>1787</td>
<td>22600000</td>
</tr>
<tr>
<td>From 1786 to 1790</td>
<td>23443670 per an.</td>
</tr>
<tr>
<td>1799</td>
<td>46000000</td>
</tr>
<tr>
<td>1800</td>
<td>56010732</td>
</tr>
<tr>
<td>1802</td>
<td>65850395</td>
</tr>
<tr>
<td>1806</td>
<td>75000000 *</td>
</tr>
</tbody>
</table>

* This year's importation is not given from official documents, and is not therefore to be relied on as strictly accurate.

London and Liverpool are the great marts for cotton, the chief part of which was for a long time imported into London, but the situation of Liverpool, in the very heart of the cotton manufactures of the north, has rendered it the principal market in the kingdom, and great part of the cotton belonging to the merchants of London is now configured there.

The following is the number of bags, of about 300 lbs. each, imported into London and Liverpool in four different years, from which may be derived a tolerably accurate idea of the relative quantities of different kinds of cotton brought into this kingdom, and of the increased cultivation of some particular sorts.
COTTON.

From these statements it appears, that in 1791, sixty-four bags of cotton only were brought into the port of Liverpool from North America; 253,814 into London and Liverpool in 1799, and in 1866, upwards of one hundred thousand bags into Liverpool alone; nearly half the quantity imported into the whole kingdom of every description whatever.

The cultivation of cotton is become an object of principal concern, and is rapidly increasing in the southern states of North America. The produce of some parts of Georgia, as we have before observed, is of very superior quality; and there is every reason to believe, that in a few years, it will rival in quantity, as well as quality, the fine cottons of Brazil and Guiana.

It may not, perhaps, be irrelevant to our subject, to remark here, that the colonization of Georgia formed the subject of a memorial presented to the duke of Newcastle, then secretary of state in the reign of George I., by Colonel John Purry, a native of Switzerland. In this memorial, which was afterwards published, he sets out with this preface, that "there is a certain latitude on our globe, so happily tempered between the extremes of heat and cold, as to be more peculiarly adapted than any other for certain rich productions of the earth," amongst which he enumerates silk, cotton, indigo, &c.; and he fixes on the latitude of 33°, whether north or south, as the identical one for that peculiar character. He wrote some years afterwards, with a colony of his countrymen, on the river Savannah, which parts Carolina from Georgia, where he perpetuated his name by founding the town of Purryburg; and proved, in some degree, the truth of his system, by the introduction of these objects of cultivation, which have since become staple articles of the country.

The first importation of cotton from the East Indies took place in the year 1798. This cotton is not imported by the India company, but by the privileged merchants; and the first cargo brought by the fame, and valued at 50,000l. cleared the enormous sum of 50,000l. The cotton at that time sold at 2s. 2d. per pound, the following year it fell to 10l., and is now the lowest priced cotton in the market.

The following is the amount of importations since that time.

<table>
<thead>
<tr>
<th>Year</th>
<th>Importation of East India Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1798</td>
<td>4637 Bales of about 350 lbs.</td>
</tr>
<tr>
<td>1799</td>
<td>19714</td>
</tr>
<tr>
<td>1800</td>
<td>19820</td>
</tr>
<tr>
<td>1801</td>
<td>12111</td>
</tr>
<tr>
<td>1802</td>
<td>8900</td>
</tr>
<tr>
<td>1803</td>
<td>10475</td>
</tr>
<tr>
<td>1804</td>
<td>5046</td>
</tr>
<tr>
<td>1805</td>
<td>1842</td>
</tr>
<tr>
<td>1806</td>
<td>8222</td>
</tr>
</tbody>
</table>

All cotton whatever is subject to a duty of 2d. per pound, and also of 14 per cent. on that amount. Calculated at the prices of that article in 1803. The amount of the duty on each particular kind is as follows.

- Sea Island Georgia: 4 per cent. ad valorem
- Fine Brazil: 8
- British West India: 8 1/2
- Foreign West India: 10
- Inferior Brazil: 12
- Turkey: 12
- Bowed Georgia: 12 1/2
- Spanish Cotton: 15 to 23 1/2

Cotton, as a vegetable substance, approaches in its nature nearly to the ligneous matter, or woody fibre, and affords, by destructive distillation, the same products, and nearly in the same proportions as the hard and heavy woods. It is distinguished by its great affinity for earthy and metallic oxides, but more especially for alumine and iron, on which is founded the theory and practice of calico-printing.

It is little alterable, insoluble in water, and the chief part of the weaker reagents. Nitric acid converts it into various vegetable acids. Vitriolic acid acts upon it as on ligneous fibre, both are decomposed, charcoal developed, and sulphureous acid given out. It is also distinguished by the beauty and permanency of the white which it acquires by alternate exposure to the action of alcalics and atmospheric air, or oxygenated natrium acid.

The structure of the fibres of cotton has not been well ascertained. Lewenhoeck, by microscopic examination, found them to have two sharp sides, and it seems to be owing to this circumstance, and to their podiforming some affinity like the filaments of wool, that cotton greatly irritates and inflames wounds and ulcers, if applied to them instead of lint.

Cotton, in Ancient Geography, a town of Asia Minor. COTTON-grafs, in Botany. See ERIOPHORUM.

Cotton Manufacture, in Commerce, one of the leading and most important branches of our national industry and commerce.

The history of its progress during the last century, affords a splendid instance of the successful application of industry and talent to a branch of manufacture, unparalleled in the annals of commerce.

Scuriously fifty years have elapsed since it was amongst the humblest of our domestic arts, and was confined chiefly to the fire side and cottage of the labouring poor of Lancashire. Its products were few, and mostly for home consummation, though some articles from Manchester were exported above a century ago. Its proceeds were simple, and the contrivances for accelerating labour, such as had been handed down for ages past with little alteration. The population engaged in this manufacture about the year 1750, is supposed not to have exceeded 20,000, and was little more than doubled in the succeeding twenty years.

From this state of comparative inutility, it burst forth at once with a vigour and activity which has no parallel, and from cauaces which we shall state hereafter, became in the short period of thirty years, one of the most flourishing and important branches of our national industry.

For our internal consumption, it affords a variety of fabrics, suited not only to the ordinary wants and comforts, but also to the elegancies of life; and for exportation, such now is our superiority, that there is scarcely a civilized nation on the earth, that is not indebted to us for some article of this manufacture, and well authenticated accounts have been published of their having been found as articles of drefs amongst the distant parts of Tartars.

In the following article we shall endeavour to trace the progress of this manufacture from its origin down to the present time, and the causes which have contributed to powerfully to raise it in a few years to a state of importance, little short of that which the great staple manufacture of this country, that of wool, has acquired during the five last centuries.

The period of its first introduction into this country is not clearly ascertained, and there are few authentic documents of earlier date than the middle of the fourteenth century.
COTTON.

century, before which time, it is probable that the manufactory of cotton was too inconsiderable to deserve much notice.

The first historical notice we meet with is in the Itinerary of Lancashire in the reign of Henry VIII. "Bolton-upon-Moor market," says he, "doth much in autumn, divers villages in the counties about Bolton do make cottons." From this an inference has been drawn in favour of the existence of the manufacture of cotton in Lancashire at this early period, a supposition which is however completely overturned by an act passed the 5th and 6th of Edward VI. 1552; entitled "for the true making of awollen cloth," in which it is ordered "that all the cottons, manchaster, lancaustre, and cheleshe cottons, full wrought for the sale, shall be in length twenty-two yards, and contain in breadth three quarters of a yard in the weft, and shall weigh thirty pounds in the piece at least. Also that all other cloths called Manchaster frizes, with the full wight for sale, shall contain in length thirty yards, and in breadth three quarters of a yard, coming out of the water, and shall not be dressed or the tenter, nor washed, nor a clothe of a yard in breadth, and heigh, to be fully wrought and well wrought, shall weigh every piece 42 lbs. at the least." However paradoxical it may appear, it is nevertheless clear from this passage that, as the Manchaster cottons of that day were a species of woollen cloth, and that of the coarsest and strongest kind, it was sufficiently proofed by the weight required by the statute. The evidence of Camden also to this point is decisive: when speaking of Manchaster in 1590, he says, "this town excels the towns immediately around it in handloomed, popularly made, awollen manufacture, market place, church and collge, but did much more excel them in the last age, as well by the glory of its woollen cloths, which they call Manchaster cottons, as by the privilege of sanctuary, which the authority of parliament under Henry VIII. transferred to Cheleshe."

The manufacture of these cloths was known also in Wales, as appears from the Itineraire of Elizabeth, 1568; in which we have the following historical fact. "In the town of Shrewsbury there hath been, time out of mind of man, and yet is, a company, fraternity, or guild, of the art and mystery of drapers, which did fraternity hath by reason of a certain trade and occupation, of buying and selling of Welsh cloth and linen, commonly called Welsh cottons, frizes and plains, which they have had and used amongst them, been able not only to live thereby, but also have, at their common coall, provided houses and other necessaries for poor people within the said town of Shrewsbury." The diffusion of the Welsh cloths here into frizes and plains, is another proof of their being made of wool.

It is certainly singular, that the term cotton should be applied to goods manufactured wholly of wool, and which from their weight and substance could not possibly be intended as imitations of, or substitutes for, the cotton goods of any other country.

The fact is however sufficiently evident from the preceding quotations, and still further from the consideration that at the present day the Kendal cottons, a manufacture which has subsisted now near five centuries, are made entirely of wool, and that of the coarsest kind.

Like the Welsh cottons they are manufactured both frized and plain; and we used chiefly for negro clothing in America and the West Indies, though some are worn at home by the poor or labouring householders. Various conjectures have been offered respecting the origin of the name, but the most probable is, that it is a corruption of the word coating. However this may be, it is very certain that the Manchaster, Cheleshe, and Welsh cottons, which in all probability were derived from those of Kendal, were made entirely of wool, and that it is to these goods the obligation of Lancashire applies in the quotation we have before given.

To whatever purpose cotton was applied, it is certain that long before we have any mention of the manufacture the raw material was imported into this kingdom. The earliest record we have with us, in a letter and not very extensive search, is preserved by the accurate and indefatigable Hakluyt in the first volume of his Collection of Voyages, and is contained in a little work entitled the "Proceeds of English Policy." The intent of the whole poem (for such it is) is to inculcate the absolute necessity to our commerce and existence as a free state, of England keeping the dominion of the seas; but it is chiefly valuable for the lift which it contains of the different natural productions, as well as manufactures, which were at that time the objects of commercial intercourse between the European states. After enumerating the various articles which constitute the trade of Spain, Flanders, Portugal, Britain, Scotland, Ireland, Prussia, Germany, and Holland, &c., he tells us, that "Coton refers to England in her huge ships, named Carracks, bringing many commodities, as cloth of gold, silk, paper, much wool, wool, oil, cotton, roach alund, and gold coin; and they bring back from us wool and woollen cloth made with our own wool." It is evident from the preceding quotation that at least as early as 1540, about which time this little work was first printed, and probably alo much earlier, this country was supplied by the Geneoes with cotton from the Levant. The Geneoes possesthe trade till the year 1515, when, according to Hakluyt, from that time to 1534, "divers tall ships of London and Bristol had an usual trade to Sicily, Caudia, and Chios, and sometimes to Cypry and to Tripoli, and Baruth in Syria. They exported thither fudrorys of woollen cloths, calfskins, &c., and imported from them silks, camels, tindars, malmsey, muscad, and other wines, oils, cotton-wool, Turkey carpets, galls, and India spices. The Levant trade was soon after engulfed by the merchants of Antwerp, and till 1575 entirely abandoned by the English. Wheeler, who wrote in 1601, says, that "a little before the troubles in the Low Countries, the Antwerpans were become the great dealers to Italy, in English and other foreign merchandise, and also to Alexandria, Cyprus, and Tripoli in Syria, beating the Italians, English, and Germans entirely out of the trade, as they also soon did the Germans at the fairs and markets of their own country." Accordingly we find from the same author, that cotton was one of the many articles with which they supplied this country at that period, which they brought chiefly from Sicily and the Levant, and sometimes from Lisbon, along with many other precious articles which the Portuguese derived at that time from India. After the freezing of Antwerp the English trade to the Levant revived, and in 1621 was in a flourishing state, as appears from the testimony of Mr. Munn, in his treatise on the trade of India, in which cotton is enumerated as one of the many articles brought by our merchants from the Mediterranean.

From these quotations it is evident, that previous to the discovery of America and the West Indies, and for some time afterwards, this country, and probably all Europe, was supplied with cotton from the Levant.

How far, from this early importation of the raw material, we have a right to infer the existence of a cotton manufacture in this kingdom, may perhaps admit of some dispute.
COTTON.

yet it is certainly very probable that, acquired as we must have been in some degree with the cotton cloths of the East, and other countries, and furnished with the material for their fabrication, some attempts would be made to imitate them. One great use of cotton no doubt, at these early periods, was for candlewicks; and to whatever purpose else it was applied, the manufacture had made no great progress in this country till the beginning of the seventeenth century, nor does it appear that on the continent, from whence, till within these few years, almost all our manufactures of cloth have been derived, the manufacture of cotton had made any progress before the middle of the sixteenth century.

Fustians were first made in Flanders, if we may credit Guicciardini, in his history of the Netherlands, who however assigns no date to their first introduction. In the little work we have before alluded to, anno 1430, preferred in "Hackluyt's Collection of Voyages," they are mentioned not only as an article of export from Flanders to Spain, but of import also from the Fayerlings, Prussia, and Germany. We are disposed to believe they were first manufactured in Italy, where, from its proximity to the countries aforesaid, cotton, as well as its earlier communication with those nations which supplied Europe with cotton cloths, it was more likely to originate, than in the more remote and northern parts of the continent; and we learn also from Guicciardini, in another part of his work, that in 1500, Antwerp annually imported from Milan "great quantities of gold and silver thread, various wrought silks, gold stuffs, fustians and dimities of many fine fortes, scarlets, tammies, and other fine and curious draperies."

That the manufacture of fustian came originally to this country from the Netherlands is highly probable, and it is said to have been established in the towns of Bolton and Manchester by Protestant refugees. Fustians were manufactured there in the beginning of the seventeenth century, and it is probable their first introduction was not much earlier. Had the Flemish carried this manufacture to any great extent, it would have found its way to this country much earlier, from the vast number of weavers and manufacturers of every description that emigrated to England, from the time of Edw. III. down to the troubles in the Low Countries during the reign of Philip II. of Spain.

In one of the summary laws of James I., passed in the parliament of Scotland in 1621, it is enacted, "that servants shall have no silk on their clothes, except buttons and garters, and shall wear only cloth, fustians, and canvass of Scotch manufacture." This prohibition would seem to imply a very advanced state of the manufacture of these articles in Scotland.

The first authentic document concerning the cotton manufacture of this kingdom, is contained in Lewis Roberts "Treasure of Traffic," published in the year 1641, and is as follows. "The town of Manchester buys the linen yarn of the Irish in great quantity, and weaving it, returns the same again in linen into Ireland to sell. Neither does her industry rest here, for they buy cotton wool in London that comes from Cyprus and Smyrna, and work the same into fustians, vermilions, and dimities, which they return to London, where they are sold, and from thence, not seldom, are sent into such foreign parts where the first materials may be more easily had for that manufacture."

The manufacture of linen cloth, properly so called, never we believe, constituted any great part of the trade of Manchester, but the fustians, and indeed all the cotton goods of that period, were made of linen warp, composed of Hamburg or Irish yarn, but chiefly of the latter, and these probably formed great part of the linen goods which Mr. Roberts says were returned to Ireland.

Soon after this period, fustians were manufactured in quantities at Bolton, Leigh, and the places adjacent; but Bolton was the principal market for them where they were bought in the grey by the Manchester dealers, who m发版 and sold them in the country. The Manchester traders went regularly on market days to buy fustians of the weavers, each weaver then procuring his own yarn and cotton as he could, which subjected the trade to great inconvenience. To remedy this, the chapmen themselves furnished warps and cotton to the weavers, and employed persons in all the little villages and places adjacent, to deliver out materials, and receive back the manufactured goods when finished. Each weaver's cottage formed at that time a separate and independent little factory, in which the raw material was prepared, carded, and spun, by the female part of the family, and supplied woof, or welt, for the goods which were wove by the father and his sons.

The kinds of fustian then made were herring-bones, pillows for pockets and outside wear, strong cotton ribs and barragons, broad-needled linen thickets and tufts, with over-plied diaper, tripled dimities and jims. These were succeeded by cotton thickets, goods figured in the loom, draw boys, and at later periods by cotton velvets, quiltings, counterpanes, corded dimities, velvets, velveteens, and strong and fancy cords. It is scarcely possible to convey any adequate idea of the varieties of cotton goods that have issued from the loom, since the first dawn of this manufacture to the present time. The pattern cards of Manchester goods went out to the continent by the leading houses engaged in the foreign trade, and presented specimens of nearly two thousand different kinds, varying in strength and fineness, from the coarse and heavy fabrics to the finest and most delicate muslins, and in colour from the richest clints to plain and self-coloured grounds; some figured in the loom, some checked and others plain, yet all, or the greatest part of them, composed entirely of cotton.

For the introduction or improvement of many of these branches, this country is indebted to the late Mr. Wilton of Ainfworth, near Manchester, originally a manufacturer of fustian. He early engaged in the manufacture of cotton velvets, which, by unwearied efforts, he brought to the utmost degree of perfection, and consideredly improved the mode of dressing, finishing, and more particularly of dyeing, which at that time was very imperfect. His goods, especially his velvets, were finished in a style that acquired a high character, both at home, and in the foreign market, and were readily distinguished from those of any other manufacturer. He cleared off the loose and uneven fibres with razors, and burnt or fanged them with spirits of wine. This mode was succeeded by the use of hot irons, in form somewhat resembling the weavers' drying iron, but rounder, which were first employed by Mr. Wilton: and at a later period by cylinders of cast iron heated to redness, over which the goods were evenly and rapidly drawn, and thus freed from that superfluous down, or pile, which they had acquired in the loom, or in the various operations of walking, bleaching, or dyeing.

Towards the middle of the last century, and soon afterwards, the manufactures above enumerated, or fuch of them as were then known, had become of great importance to the towns of Manchester and Bolton, affording various articles for home consumption, as well as for an increasing foreign trade, and giving employment to great part of the population of the surrounding country. They had arrived at that state at which a pause must naturally have ensued, and beyond.
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beyond which they must have advanced with the flow and gradual increase of population; which, aided by every advantage, as well as by emigration from other districts, could never have kept pace with the demand, without the introduction of those improvements to which this country owes the most glorious and unrivaled state of its cotton manufactures, and of which we shall now proceed to give some account.

The mode of spinning in use in this country at that period was by the hand; on the well known domestic machine called a madder wheel. A single spindle put in motion by a wheel and band turned by the right hand, whilst the thread was managed by the left, composed the whole of this simple apparatus, on which one person could with difficulty produce a pound of thread, by close and diligent application, the whole day. The goods then manufactured were strong and coarse, compared with those of the present day, and little or no thread finer than from 16 to 20 hanks in the pound, each hank measuring 840 yards, was then spun. It was subject, as may readily be conceived, to great inequalities, its evenness depending greatly on the delicacy of touch, which the spinner by long habit had acquired, and varied with every little difference in the extension of the thread during twisting, and the revolution of the spindle in portions of the same length. As the demand for cotton goods increased, various contrivances were thought of for expediting the part of the manufacture. A patent was taken out by a person named Paul, and some others of London, for an engine for a more easy and expeditious mode of spinning cotton, and several other attempts were made at frequent periods, but all with equal want of success, till the invention of the Jenny, by James Hargreaves, in the year 1767.

Hargreaves was a weaver at Stanhill, near Church, a few miles distant from Blackburn, in Lancashire. He was a plain, industrious, but illiterate man, and possessed little mechanical skill or talent. He retired near the print ground, the full and infant establishment of the late Robert Peel, Esq. from whose hints and conversation he derived much important assistance, and whole strong and active mind was at that time engaged in the promotion of every useful improvement connected with that branch of manufacture, in which he was afterwards so extensively concerned. An anecdote is full recorded in the neighbourhoood, which, as a means to accident the parent of so many useful discoveries, the first invention of the Jenny. A number of young people were one day assembled at play in Hargreaves' house, during the hour generally allotted to dinner, and the wheel at which he or some of his family were spinning, was by accident overturned. The thread still remained in the hand of the spinner, and as the arms and periphery of the wheel were prevented by the framing from any contact with the floor, the velocity it had acquired still gave motion to the spindle, which continued to revolve as before. Hargreaves surveyed this with mingled curiosity and attention. He expressed his surprise in exclamations which are still remembered, and continued again and again to turn round the wheel as it lay on the floor, with an interregnum which was at that time mistaken for mere indolence. He had before attempted to spin with two or three spindles affixed to the ordinary wheel, holding the several threads between the fingers of his left hand, but the horizontal position of the spindles rendered this attempt ineffectual; it is not therefore improbable, that he derived from the circumstance above-mentioned the first idea of that machine which paved the way for subsequent improvement. It consisted at first of only 8 spindles, turned by bands from an horizontal wheel, in the centre of which was fixed a vertical shaft, with a handle at the top for the spinner. The threads passed between two horizontal pieces of wood, the breadth of the machine, which, when prefixed together, clapped flat the reeling like the finger and thumb of the spinner, and were thus extended or drawn out. He had great difficulty in putting up the thread, or winding it on the spindle after twisting, which he at last accomplished by means of a treadle connected with a wire, and worked by the foot of the spinner. The Jenny in its original form was a rude machine. The flirt was made almost wholly with a pocket knife; and the chafy, by which the thread was drawn out, was the stalk of a brier split in two. It was, as may readily be conceived, defective in the construction of those parts essential to the performance of its work, and which an ordinary mechanic would have had no difficulty in contriving; but Hargreaves was obliged to work in secret, and possessing little mechanical skill, to avail himself of such assistance as he could procure, without making public the object he had in view.

Popular prejudice was soon excited against him, and the threats of his neighbours obliged him to conceal his machine for some time after it supplied the woof or weft for his own looms. It was, however, generally known that he had made a spinning machine, and his wife, or some of his family, having imprudently boasted of having flung a pound of cotton during a short absence from the sick bed of a neighbouring friend, the minds of the ignorant and misguided were alarmed, and they shortly after broke into his house, destroyed his machine, and also part of his furniture. Hargreaves soon after removed to Nottingham, whither he was invited by the flocking weavers of that place, and where he assisted in the erection and management of a mill, about the time that Mr. Arkwright first settled there, after being in the same manner driven out, or rather deterred from settling in Lancashire, by the clamour and prejudice of the people. Hargreaves was little qualified, either by education or address, for the sphere of life into which he was removed, and after having assisted various persious in the construction of machinery, and communicated to each by turns the whole of what he knew, he died in poverty, ill requited by his employers, and little known to the country, which has since reaped such important benefits from his discovery. Before he quit Lancashire, he had made one or two wheels of 12 or 16 spindles each for some of his relations or friends, and as the popular clamour abated, the number of these increased, till a second mob scourd the whole country and destroyed every machine, they could meet with. The value of this improvement however was so strongly felt, and the measures adopted against the ring guardians of this outrage so vigorous and decisive, that new wheels were immediately constructed, and it was remarked that many of those concerned in opposing their first introduction, were amongst the foremost to avail themselves of the advantages they now promised. Various alterations were made in the original machine, which from its form was inconvenient and tiresome to grown up persons, though girls of twelve or fourteen managed it with ease. The vertical wheel was substituted for the horizontal one, which rendered it much easier to work, and the treadle, which required an awkward and constrained posture, was rendered unnecessary by a simple contrivance managed by the hand. They were enlarged in their dimensions from twelve to twenty, and afterwards to thirty, fifty, and even eighty spindles, and their use rapidly extended over all the country, though their first introduction everywhere where met with the most determined opposition. Even at Nottingham, if our information be correct, a furious affair took place on the first erection of the new machines, in which Hargreaves himself was severely wounded, and a young woman, who had accompanied him from Lancashire.
cashire, and had been accustomed to the management of his first Jenny, nearly lost her life.

To Hargreaves also is ascribed an improvement in the mode of carding, which, before his time, had been performed with hand cards, on the knee, a tedious and laborious operation. These were succeeded by flock cards, in which the lower card was fixed immovable on a floor or flock, which left both hands at liberty to manage the upper one. These were first used in the woollen manufacture, and introduced into Hargreaves’ neighbourhood from Rosendale. His improvement consisted in applying two or three cards to the same flock, and suspending the upper cards, which from their weight and size would otherwise have been unmanageable, from the ceiling of the room by a cord passed over a pulley, to the other end of which was affixed a weight or counterpoise. With these, one woman could perform twice as much work, and with greater ease than the could do before in the common way.

The flock cards were succeeded soon after by cylinder cards, the invention of which is claimed by so many different persons, that it is impossible now to determine to whom the merit is due. Amongst the first who employed them, was the late Mr. Peel, who constructed a carding engine with cylinders at Blackburn, as early as the year 1762, in which he was assisted by Hargreaves.

Mr. Peel’s engine consisted of two or three cylinders, covered with cards, but had no contrivance for stripping, or taking off the carded cotton. This was performed by two women with hand cards, who alternately applied them to the carding machine, and thus took off the carding by turns. This was, in all probability, the first carding machine that was made; but Mr. Peel’s other avocations not permitting him to pursue the subject at that time, it was laid aside, and some years elapsed before it was improved and perfected by other hands.

Notwithstanding the severe punishment of the ringleaders of the late outrage, and the friendly means adopted to convince the labouring class of the folly and injustice of opposing these improvements, by which not only the country, but themselves, would in the end be materially benefited, considerable alarm and uneasiness were again excited, and though no scarcity of work had been experienced, a belief universally prevailed, that all manual labour would soon be annihilated by the use of these new machines, and more numerous mobs therefore assembled in the year 1779, by which all the machinery turned by water or horses, both for carding and spinning, and all the Jennies above a certain size, that could be found within eight or ten miles of Blackburn, were completely destroyed. Jennies of twenty spindles, or under, were alone respected, every machine turned by water was demolished, and the large Jennies were either cut into two small ones that came within the fire prescribed, or if the owner chose, into one of twenty spindles, by sawing off the extra number which was often confounded to the flames. These and similar disturbances in different parts of the country impeded for an instant, but could not arrest the progress of this manufacture. Mr. Peel, whose machinery at Alston was totally destroyed and thrown into the river, and whose personal safety was sometimes in danger from the fury of a licentious and unaccountable mob, retired to a district from the country, and established a cotton mill at Burton in Staffordshire, on the banks of the Trent, where he continued to reside many years afterwards.

Soon after the invention of the Jenny in 1767, Sir Richard, at that time Mr. Arkwright, brought forward his improvement in spinning, on which he had been long and laboriously engaged. This distinguished character, whose perseverance and invention raised him from one of the most humble occupations in society to influence and honour, was the youngest of thirteen children, and was born in the year 1732, at Preston, in Lancashire. In this neighbourhood was then carried on a considerable manufacture of linen goods, and linen and cotton mixed, the various operations of which he had an opportunity of becoming intimately acquainted with, and being a man of uncommon natural powers, he directed his thoughts to the improvement of the mode of spinning, which had probably been conducted for ages by the same processes. The first hint for effecting this improvement, he accidentally received from seeing a red-hot iron bar elongated, by being passed through iron rollers. Between this operation and that of elongating a thread, as now practised in spinning, there is no mechanical analogy; yet this hint being purloined, has produced an invention, which, in its consequences, has been a source of national and individual wealth unparalleled in the annals of the world.

The difficulties which Mr. Arkwright experienced before he could bring his machine into use, even after its construction was sufficiently perfect to demonstrate its value, would perhaps for ever have retarded its completion, if his genius and application had not been unfavourable to enable him to commence business on his own account, and few were willing to risk the loss of capital on a new establishment.

Having at length, however, had the good fortune to secure the co-operation of some persons who saw the merit of the invention, and were willing to assist his endeavours, he obtained his first patent for spinning by means of rollers in the year 1769, and to avoid the inconvenience of establishing a manufacture of this kind in the heart of the cotton manufacture, such as it then existed, he removed to Nottingham. Here, in conjunction with his partners, he erected his first mill, which was worked by horses, but this mode of procedure was found to be too expensive, and another mill on a larger scale was erected at Cromford in Derbyshire in the year 1771, the machinery of which was put in motion by water.

This patent right was contested about the year 1772, on the ground that he was not the original inventor. He obtained a verdict however, and enjoyed the patent without further interruption to the end of the term for which it was granted.

As the essential part of Mr. Arkwright’s machine was entirely new, and was applied with the happiest success in various other forms for preparing the raw material for spinning, of which we shall speak hereafter, we shall pause a while in the historical detail of these inventions, and explain the general principles of its construction, and the mode in which its operation was performed. Previous to the year 1767, as we have already observed, all the spinning was performed on the domestic one-thread wheel, of which there were two kinds. The first, which we have before described, required the raw material to be previously prepared and carded, and was used for wool and cotton. The cardings were left and loose rolls of the thickens of a candle, and from eight to twelve inches long, possessing little length or tenacity, the lightest breeze being sufficient to break or pull them asunder. One end of this roll being held between the fingers of the spinner, and the other twisted round the point of the spindle, was rapidly drawn out during its revolution, and formed a coarse loft thread called a reeing. For coarse woollen goods, this operation was sufficient,
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Evident that the quicker revolution of the second pair, will draw out the cotton, rendering it thinner and longer, when it comes to be delivered at the other side. This is precisely the operation which the spinner performs with his finger and thumb, and the application of this simple and beautiful contrivance to the spindle and fly of the common flax wheel produced that machine for which Mr. Arkwright's first patent was obtained, and which laid the foundation of all his subsequent discoveries.

Soon after the erection of his mill at Cromford, Mr. Arkwright made many improvements in the mode of preparing the cotton for spinning, and invented a variety of ingenious machines for effecting this purpose in the most correct and expeditious manner; for all of which he obtained a patent in the year 1775.

The validity of this second patent was tried in the court of King's Bench, in the year 1781, and a verdict was given against him on the ground of the insufficiency of the specification, but on the 17th of February 1785, in the court of Common Pleas, before Lord Loughborough, the question was again tried, and he obtained a verdict, having established by evidence the sufficiency of the specification.

This verdict, in consequence of great numbers having engaged in the erection of machines during the interval of four years that had elapsed since the former decision, occasioned considerable alarm, and roused a host of enemies, from whom a premium on each spindle was demanded, under the threat of immediate ruin. An application was made of the manufacturers principally concerned in the business, and another cause instituted by writ of fieri facias, was tried before Judge Buller in the court of King's Bench, on the 15th of June 1785, in which, after a very long trial, he was again on the ground of his not being the original inventor.

Conscious that this was not the case, he moved in the court of King's Bench, on the 10th of November 1785, for a new trial, stating that, not being aware of the nature of the evidence to be brought forward on this trial for the first time after so many years had elapsed, he was then unprepared, but was now able to substantiate by proofs the falsity of great part of the evidence which went to that point. The rule however was refused, and on the 14th November 1785, the court of King's Bench gave judgment to cancel the letters patent.

The inventions claimed by Mr. Arkwright, which gave rise to these reiterated contests with the rival manufacturers of Lancashire, related chiefly to the operation of carding, which was now brought to great perfection. Before we enter however into any account of these improvements, it will be necessary to take a short view of the nature of this operation, and the mode in which it was performed at the date of Mr. Arkwright's second patent.

The card is a kind of brush made with wires instead of hair, stuck through a sheet of leather; the wires not being perpendicular to the plane, but all inclining one way in a certain angle.

From this description, such as are totally unacquainted with the subject, may conceive that cotton, being fuddled upon one of these cards or brushes, may be scraped with another card in such a direction, that the inclination of the wires may tend to throw the cotton inward, rather than suffer it to come out. The consequence of the repeated strokes of the empty card against the full one, must be a distribution of the cotton more evenly on the surface, and if one card be then drawn in the opposite direction across the other, it will, by virtue of the inclination of its wires, take
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take the whole of the cotton out of that card, whose inclination is the contrary way.

In this mode, the operation of carding was formerly performed by hand with sheets of card nailed upon thin boards, which were drawn and scraped against each other, till the cotton or wool was evenly diffused over the surface, and freed from all the knotty or entangled parts. One of the cards being then turned and applied in an inclined position, so as to scrape with one edge over the surface of the other card, in the direction of its teeth, the cotton was, by a particular manoeuvre, stripped off and coiled up into loose short soft rolls which we have spoken of already under the name of carding. Such, in all probability, was the process employed with little alteration, during the five last centuries in the woollen manufacture of this kingdom, and applied at subsequent periods to the preparation of cotton. The use of cards was most likely derived from the Netherlands, at or before the time our woollen manufactures were improved by the emigration of Flemish weavers to this country, during the reign of Edward III.

They continued to be imported hither till the year 1463, when the tradesmen and manufacturers of London, and other parts of England, having made heavy complaints to parliament of the obstruction to their own employment by the introduction of various foreign manufactured wares, an act was passed in the third year of Edward IV., prohibiting wood-cards, and various other articles of iron, steel, copper, &c. from being imported into this kingdom.

The hand-cards were succeeded by flock-cards, and these again by cylinder cards, as we have already observed, which were first attempted about the year 1763.

This machine consisted of two or more large cylinders covered with cards, revolving in opposite directions, and nearly in contact with each other, and surmounted by other smaller cylinders covered in like manner, by whose revolutions in various directions, and with different velocities, the cotton was carded and delivered to the last or finishing cylinder, from which it was stripped off by different contrivances. The cards were nailed on in stripes, or sheets of fix or eight inches broad, and the margin of each sheet in which the nails were driven, being deficient of teeth, formed so many intervals or furrows across the surface of the cylinder.

The cotton was stripped off first by hand, as in Mr. Peel's machine, and afterwards by a fluted cylinder, or by a roller armed with slips of tin-plate or iron, standing erect like the floats of an underfoot wheel, and which revolving quicker than the card, and in close contact with it, scraped off the cotton in distinct portions from each stripe or sheet, which fell into a receptacle below. This was a hard and rude operation, and rubbed and injured not only the carding, but the cards themselves. Mr. Arkwright substituted for the fluted cylinder a plate of metal finely toothed at the edge, and moved in a perpendicular direction rapidly up and down by a crank.

The flight, but reiterated strokes of this comb, acting on the teeth of the cards, detached the cotton in a fine and uniform fleece. On the finishing cylinder also, narrow fillet-cards, as they are termed, wound round in a spiral form, were substituted for the ordinary cards nailed across.

The continuity of the fleece was thus preferred, which was destroyed before by the intervals or furrows we have alluded to, and being gradually contracted in its size, by passing through a kind of funnel, and flattened or compressed between two rollers, was delivered into a tin can in one continued, uniform, perpetual carding, so long as the machine continued in motion, and was supplied with the raw material.

This is, without exception, one of the most striking and beautiful operations in the whole process of spinning. Mr. Arkwright's right to the invention of the crank and comb was the disputed point at the last hearing of this cause, and the evidence which he was unprepared to meet having proved to the satisfaction of the jury, the prior claim of a mechanic, named Heyes, his exclusive right, not only to this improvement, but to all others included in the same patent, was cancelled by the judgment of the court. How far Mr. Arkwright would have been able in the event of another hearing to have disproved the evidence thus unexpectedly brought forward, is not easy to determine. That the crank had been applied in some way or other, prior to the date of Mr. Arkwright's patent, though in a much less efficacious and approved manner, we believe will admit of the fullest proof, and this circumstance, in a cafe in which the interest of a great body of manufacturers was deeply concerned, and was opposed only by that of a single individual, would, in all probability, have confirmed the former decision in a court already weary of the discussion.

The improvement, as far as Mr. Arkwright was concerned, was original, and undoubtedly his own, and bears evident marks of that genius and happy invention which strongly characterize every part of his machinery. He was anticipated in a single idea before it was matured and brought forth, and in this instance left the fruits of his industry and talents. His claim to the spiral cards, which produce the endless, or perpetual carding, has however never been disputed. At the same time Mr. Arkwright brought forward other machines peculiarly adapted to the preparation of the materials for his own mode of spinning, and founded on the principle of his former invention. The first of these, in the series of successive operations, is the drawing frame.

This machine consists of a cylinder of rollers similar to those before described in the twist frame, revolving with different velocities, either from the variation of size in the pairs of rollers, their performing a different number of revolutions in the same space of time, or from both these causes united. Three or more cardings coiled up in deep tin cans are applied at once to these rollers; in their passage through the rollers, they not only coalesce so as to form one single drawing, but are also drawn out or extended in length. This process is several times repeated; three, four, or more drawings, as they are now termed, being united and passed between the rollers; the number introduced being so varied, that the last drawing may be of a size proportioned to the fineness of the thread into which it is intended to be spun. By this operation, the fibres of the cotton are drawn out longitudinally, and disposed in an uniform and parallel direction, and all inequalities of thickness are done away by the frequent doubling or joining of to many different lengths.

A third machine was contrived by Mr. Arkwright for giving the necessary degree of twist to these prepared lengths of cotton. In the rate in which it comes from the drawing frame, it has little strength or tenacity, and is received into similar deep cans, from whence it was passed through the rollers. To enable it to support the operation of winding, it is again passed through a cylinder of rollers similar to those in the last machine, and received in a round conical can revolving with considerable velocity. This gives the drawing a slight twining, and converts it into a soft and loose thread, now called a roving, which is wound by the hand upon a bobbin, by the smaller children of the mill, and then carried to the spinning or twist frame, of which we have already spoken.

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Such are the inventions and improvements for which we are indebted to the genius of Mr. Arkwright, and which complete a series of machinery, so various and complicated, yet so admirably combined and well adapted to produce the intended effect in its most perfect form, as to excite the admiration of every person capable of appreciating the difficulty of such an undertaking. And that all this should have been accomplished by the single efforts of a man without education, without mechanical knowledge, or even mechanical experience, is most extraordinary, and affords a striking instance of the wonderful powers displayed by the human mind, when its powers are ideally directed to one object.

Yet this was not the only employment of this eminent man, for at the same time that he was inventing and improving the machinery, he was also engaged in other undertakings, which any person, judging from general experience, must have pronounced incompatible with such pursuits. He was taking measures to secure to himself a fair proportion of the fruits of his industry and ingenuity; he was extending the business on a large scale; he was introducing into every department of the manufacture a system of industry, order, and cleanliness, till then unknown in any manufactory where great numbers were employed together, but which he so effectually accomplished, that his example may be regarded as the origin of almost all similar improvements.

When it is considered, that during this entire period he was afflicted with a grievous disorder (a violent asthma) which was always extremely opprobrious, and threatened sometimes to immediately terminate his existence, his great exertions must excite astonishment. For some time previous to his death, he was rendered incapable of continuing his usual pursuits, by a complication of diseases, which at length deprived him of life, at the Rock House, Cromford, on the 3d of August 1792, in the 60th year of his age.

The honour of knighthood was conferred on him in December 1786, on the occasion of presenting an address to his majesty.

In the infancy of the invention, Sir R. Arkwright expressed ideas of its importance, which to persons less acquainted with its merits appeared ridiculous, but he lived long enough to see all his conceptions more than realized in the advantages derived from it, both to himself and his country; and the state to which those manufactures dependant on it have been advanced since his death, makes all that had been previously effected appear comparatively trifling.

The system of spinning introduced by Sir Richard was found most particularly applicable to the production of thread for warp, whilst the Jenny of Hargreaves was chiefly employed in spinning the woof, or web, for the coarse kinds of which it was better adapted, indeed, than the more perfect machine of Sir Richard.

On these machines were spun for some years after their introduction all the twist and weft in the kingdom; the use of the Jenny has, however, since been almost wholly superseded by a third machine, called a Mule, for the invention of which we are indebted to the ingenuity of Mr. Samuel Crompton of Bolton.

The mule was invented about the year 1776, during the term of Sir Richard's patent right, and did not on that account come into general use till after its expiration. It is a compound of the two machines of Arkwright and Hargreaves, and is considered, as its name imports, as the offspring of the twist frame and Jenny. It consists of a system of rollers like those of the twist frame, through which the roving is drawn and received upon spindles, revolving like those of the Jenny, and from which it acquires the twist. The carriage on which the spindles are disposed is moveable, and receding from the rollers somewhat quicker than the thread is delivered, draws or extends it in the same manner as is done by the Jenny. See MULE.

This completes the series of machines now in use, and is the only important discovery in spinning since the invention of Sir Richard Arkwright, on which indeed its chief merit is founded.

Of its excellence, and also of those other machines employed in the different preparatory processes, some idea may perhaps be formed, when it is stated that a pound of fine cotton has been spun on the mule into 350 hanks, each hank measuring 340 yards, and forming together a thread 167 miles in length.

Hitherto we have entered only into such details of the different processes of spinning as were necessary to elucidate the history of their invention, and exhibit both the sources and progress of the various improvements.

The operations which cotton undergoes in its passage from the raw material to the slate of thread, are various and multiplied in proportion to the fineness required, and the different uses to which it is destined.

If we analyze these operations, they resolve themselves into the following: Battling, carding, doubling, drawing, and twilling. The three latter are never performed singly, but are variously joined in the same machine; and the same elementary processes are sometimes repeated in different machines, with various and different effects.

With reference to these effects, the operations which cotton undergoes, may be denominated battling, carding, drawing, and doubling, roving, and spinning.

Battling is that operation which prepares the cotton for carding, by opening and disengaging the hard comprised masses, in which it comes from the bales. It is performed by beating the cotton with flicks on a square frame, across which are stretched small cords, about the thickness of a goose quill, with intervals sufficient to suffer the feed, leaves, and other adventitious matter to fall through.

When a hard matted or compressed mass of cotton is firmly struck with a flick, the natural elasticity and resiliency of its fibres, gradually loosen and disengage them, and the cotton recovers by repeated flicks all its original volume. During this operation the feeds, &c. which adhere, are carefully picked out by the hand, and the cotton rendered as clean as possible.

Battling is generally and best performed by hand, though the facility of hands and cloth of labour have rendered other contrivances necessary. For a description of the battling machine, with other particulars relative to this operation, see MACHINE.

Carding is that operation in which the first rudiments of the thread are formed. It is performed, as we have before stated, by cylinders covered with wire cards, revolving with considerable swiftness in opposite directions, nearly in contact with each other, or under a kind of dome or covering, the under surface of which is covered with similar cards, whose teeth are inclined in a direction opposite to those of the cylinder.

By this means the separation of almost every individual fibre is effected, every little knotty or entangled part disengaged, and the cotton spread lightly and evenly over the whole surface of the last or finishing cylinder, from which it is stripped by the contrivance we have already described.

For Jenny spinning, which is still in use for the coarser kinds,
kinds of thread, the cardings are stripped off in separate lengths. The finest cylinder is covered with the ordinary cards nailed on in stripes, acrot, and the cotton contained between the margins of intervals of each stripe, forms one carding, whole length of course depends on the width of the engine, or cylinder. When stripped off by the crank and comb, it forms a loose and shapely film, which falling on the surface of a plain wooden cylinder, the lower half of which revolves within a hollow shell or casing, the cotton in its passage is rolled up and delivered at the other side in perfect and cylindrical cardings.

For mule or water spinning, the cylinder is covered with spiral or fillet-cards, and the cotton being taken off in one continued fleece, and contrasted by passing through the funnel and rollers, forms one carding and perpetual carding, which is interrupted only, or broken, when the tin can that receives it is completely filled.

In the Jenney carding, the fibres of the cotton are disposed across or at right angles to the axis of the cylinder; in the perpetual carding they are disposed longitudinally, or in the direction of its length, and it is this circumstance which renders the carding defined for mule or water spinning, inapplicable to the Jenney, and vice versa. For further details, and a description of the carding engine, we must refer our readers to the article Engine.

Drawing, and doubling, is one of the preparatory processes for which we are indebted wholly to Sir Richard Arkwright, and belongs exclusively to the mule, or water spinning.

The doubling, or paffing three or four cardings at once through a system of rollers, by which they are made to coalesce, is intended to correct any inequalities in the thicknesses of the cardings, and also to admit of their being frequently drawn out or extended by passing through the rollers. The effect of this frequent drawing is to disperse the fibres of the cotton longitudinally, and in the most perfect state of parallelism. The operation of carding effects this in a certain degree; yet the fibres, though parallel, are not straight but doubled, as may easily be supposing from the teeth of the cards catching the fibres sometimes in the middle, which become hooked or fastened upon them. Their disposition is also farther disturbed by the take-off or comb, which flings them from the finishing cylinder; and through the general arrangement of the fibres on a carding is longitudinal, yet they are doubled, bent, and interlaced in such a way, as to render the operation we are now speaking of absolutely necessary.

When the cardings have been passed four or five times through the drawing frame, every fibre is stretched out at full length, and disposed in the most even and regular direction; and though the average length of a fibre of cotton is not two inches, yet the finished drawing, as these prepared cardings are now termed, has all the appearance of a lock of Jersey wool, whose fibres, six or eight times as long as those of cotton, have been carefully and smoothly combed.

Roving, is that operation by which the prepared cotton, as it comes from the carding engine, or drawing frame, is twisted into a loose and thick thread, and wound upon a spindle or bobbin.

In Jenney spinning, the cardings are roved without any other preparation, by a machine called a roving billy, for a description of which, with other particulars relative to Jenney spinning, see Jenney.

In mule or twill spinning, the prepared carding or drawing, as it is termed, is again passed through a system of rollers, and is twisted, either by a rapidly revolving can, into which it is delivered from the rollers, or by a fly and spindle similar to those of the flax wheel; in the latter case it is wound on the bobbin by the machine; in the former it is received in the conical can in which it acquires the twist, and is afterwards wound upon bobbins by the smaller children of the mill.

Sir Richard Arkwright always employed the revolving can, and it is still employed in many of the first mills in the country. The roving frame with fly and spindle, which is in fact nothing more than the twist frame of Sir Richard, is now however very generally in use, especially since later improvements have removed objections to the machine, which rendered its use heretofore inconvenient. See Frame.

The operations through which the thread passes after it has received the first twist are various, and depend greatly on the use it is intended for.

The finer it is required, the oftener it is drawn out and twilled, till by degrees, as in the process of wire-drawing, it is brought down to the fineness required. The rovings are therefore distinguished into first, second, and third, according to the number of operations they have gone through.

Spinning is the last operation which the thread undergoes in the series of processes employed in converting it into thread, and is that in which it receives the final extension and twilling.

It is performed either on the Jenney, twist frame, or mule. Of these machines we have already spoken generally, and also of the nature of their operation; for further and more particular details, we must refer our readers to their proper heads.

Such are the operations by which the raw material is brought into the state of thread, and such the improvements by which the cotton manufacture of this kingdom has arrived at its present unexampled state of prosperity. We cannot give our readers a better idea of the effects immediately resulting from these various improvements and discoveries, than by the following extracts from a pamphlet, published in the year 1788, intitled, "An Important Crisis in the Calico and Muslin Manufactures of this Country explained," the purport of which was to warn the nation of the bad consequences which would result from the rivalry of the East India cotton goods, which then began to be poured into the market in increased quantities, and at diminished prices.

The author affords, that, not above 20 years before the time of his writing, the whole cotton trade of Great Britain did not return 200,000l. to the country for the raw material, combined with the labour of the people; and at that period, before the introduction of the twist frame and Jenney, the power of the single wheel could not exceed 50,000 spindles:

In 1787, the number of cotton mills, as near as intelligence could be procured, was as follows:

<table>
<thead>
<tr>
<th>County</th>
<th>Number</th>
<th>County</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lancashire</td>
<td>41</td>
<td>Flintshire</td>
<td>3</td>
</tr>
<tr>
<td>Derbyshire</td>
<td>22</td>
<td>Pembroke</td>
<td>1</td>
</tr>
<tr>
<td>Nottinghamshire</td>
<td>17</td>
<td>Lanarkshire</td>
<td>4</td>
</tr>
<tr>
<td>Yorkshire</td>
<td>11</td>
<td>Renfrewshire</td>
<td>4</td>
</tr>
<tr>
<td>Cheshire</td>
<td>8</td>
<td>Perthshire</td>
<td>3</td>
</tr>
<tr>
<td>Staffordshire</td>
<td>7</td>
<td>Edinboroughshire</td>
<td>2</td>
</tr>
<tr>
<td>Westmoreland</td>
<td>5</td>
<td>Rest of Scotland</td>
<td>6</td>
</tr>
<tr>
<td>Berkshire</td>
<td>2</td>
<td>Isle of Man</td>
<td>1</td>
</tr>
<tr>
<td>Rest of England</td>
<td>6</td>
<td></td>
<td>119</td>
</tr>
</tbody>
</table>

The
COTTON.

The whole being 143, the cost of which was estimated at £175,000. There were at the same time 550 mules, and 20,000 Jennies, containing, together with the water frames, 1,951,000 spindles; the cost of which, and of the auxiliary machines, together with that of the buildings, is stated to have been at least £285,000.

The total expenditure being £1,000,000.

These establishments, when in full employment, were estimated to produce as much cotton yarn as could be spun on the single spindle by a million of persons; and instead of diminishing the employment of the people as was apprehended, they called vast numbers from idleness to comfortable independence. At this time they were supposed to give employment to 26,000 men, 31,000 women, and 53,000 children in spinning alone; and in all the subsequent stages of the manufacture, the number of persons employed, was estimated at 13,330 men, 59,000 women, and 48,000 children, making an aggregate of 159,000 men, 90,000 women, and 101,000 children, in all 350,000 persons employed in the different branches of the cotton manufacture.

The quantity of the raw material consumed in this manufacture, which in 1781 did not amount to 6,000,000 lbs., in the year 1787 exceeded 22,000,000. The astonishing rapidity of this increase, which will be more clearly shown by the following statement, is to be in a great measure attributed to the extension of the manufacture to the goods of India, particularly calicoes and muslins.

Cotton used in the Manufactures of Great Britain.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pounds</th>
<th>Supplied Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1781</td>
<td>5,101,020</td>
<td>£2,000,000</td>
</tr>
<tr>
<td>1782</td>
<td>11,260,810</td>
<td>3,000,000</td>
</tr>
<tr>
<td>1783</td>
<td>9,554,179</td>
<td>3,000,000</td>
</tr>
<tr>
<td>1784</td>
<td>11,280,238</td>
<td>3,000,000</td>
</tr>
<tr>
<td>1785</td>
<td>17,923,888</td>
<td>6,000,000</td>
</tr>
<tr>
<td>1786</td>
<td>19,151,167</td>
<td>6,000,000</td>
</tr>
<tr>
<td>1787</td>
<td>22,000,000</td>
<td>7,500,000</td>
</tr>
</tbody>
</table>

The cotton imported for the manufacture of 1787, was of the following growth:

- British West India, estimated at 6,600,000 lbs.
- French and Spanish settlements 6,000,000
- Dutch Settlements 1,700,000
- Portuguese ditto 2,500,000
- East India, procured from Oostend 5,120,000
- Smyrna and Turkey 5,700,000

Total 22,600,000

The application of this cotton to the different branches of manufacture was supposed, by intelligent persons, to have been as follows:

- Candlewicks 1,500,000 lbs.
- Hosiery 1,500,000
- Silk and Linen mixtures 2,000,000
- Fustians 6,000,000
- Calicoes and Muslins 11,600,000

Total 22,600,000

In the branches applicable to muslin and calico alone, it was calculated that employment was given in England and Scotland to 100,000 men and women, and at least 60,000 children.

The improvements of the Irish in the same line of industry must not be overlooked, and the laudable and spirited exertions of captain Robert Brooke deserve to be more particularly noticed. In the year 1785, that gentleman established a cotton manufacture on his lands situated on the great canal about 18 miles W. of Dublin. In 1782, the government of Ireland, understanding that some of the manufacturers of Manchester intended to remove to America, and carry their machinery with them, found means to persuade them to go to Ireland, and gave captain Brooke about £3000 l. for settling them in houses upon his lands, and they afterwards advanced him £30,000 l. upon interest and security, that he might give employment to a great number of weavers who were then starving and riotous for want of employment in Dublin. By means of these and other acquisitions of inhabitants, the manufacturing village which was called Prosperous, consisted now of several hundred houses, erected on a spot where, in the year 1780, there stood once a single hut; and the manufacture gave employment to about three thousand men, women, and children. Besides captain Brooke's, which was the principal one, there were at this time several other manufactures of cotton established in various parts of Ireland by the spirited exertions of individuals, and the liberal encouragement of parliament.

It may be proper here to observe, that two spinning mills were established in France, near Rouen, under the direction of Mr. Holker, an English manufacturer, who, with his partners, was assailed and patronized by the French government; and it was not long before Arkwright's machinery was even transported across the Atlantic, and a spinning mill erected in Philadelphia.

Calicoes were first brought thither from India in the year 1631, and derived their name from the province of Calicut, where they were chiefly made or exported. They were first manufactured in this country about the year 1772, or 1773. Various attempts had been made previous to this time to manufacture cloth with cotton warp or web, but owing to the imperfection of the twirl or yarn, spun either on the one thread wheel or Jennys, they all proved unsuccessful. The warp was too flimsy, and unable to support the texture or tension of the loom, or when it did, too soft to form a cloth of firm and useful texture. The improvements that rapidly followed the introduction of machine spinning, and more especially those of sir Richard Arkwright, soon remedied this defect; yet, though most excellent yarn or twirl was produced, the manufacturers could not at first be prevailed upon to weave it into calicoes. Mr. Strutt, therefore, of Derby, in conjunction with Mr. Samuel Need, both in partnership with sir Richard Arkwright, attempted the manufacture of calicoes about the year 1773, and proved successful; yet after a large quantity had been made, it was discovered that they were subject to double the duty (5½, 6d. per yard) of cottons with linen warp, and when printed were prohibited. They had therefore no other resource than to ask relief of the legislature, which, after great expense and opposition, they at length obtained, and thus laid the foundation of a branch of manufacture which has since become one of the most important in the kingdom.

The manufacture of calicoes was begun at Blackburn, in Lancashire, about this period also, at first from twirl spun in the neighbourhood upon Jennies, but afterwards principally...
COTTON.

from the water twill. The goods manufactured here before the introduction of calicoes, were Blackburn greys, made of cotton woof, but linen warp of Hamburgh or Irifi yarn, but chiefly of the latter. These goods, which were the calicoes of that day, were manufactured as early as the year 1757, at which period all the cotton goods, such as pillows, jeans, jennets, most of the cords and thicklets were made with linen warp, and even the warps for dimities were half linen. The Blackburn greys were fold in the unbleached state to the calico-printers of London, and afterwards to those of Lancashire and Cheshire, till the introduction of the real calico put a stop to this manufacture about the year 1775.

Blackburn has since become the great mart for calicoes, and the chief source from whence the printers of Lancashire, as well as those of London and Scotland, are supplied. The quantity manufactured, or rather sold there, (for the Blackburn houses employ weavers in all parts of the surrounding country, and even at considerable distances) amounted a year or two ago to upwards of one million pieces annually. The quantity now made is perhaps less than this, but of finer quality, a larger capital is employed, and the manufacture is on the increase.

The quantity of calicoes manufactured in the whole kingdom, not twenty years ago, was little more than half what the Blackburn market now affords, and it is probable that this forms but a small part of the quantity annually made in this country. They are chiefly printed into garments, frocks, and furnishings for home consumption, and a considerable foreign trade. The finer sorts are worn as dreeses, white or plain, and large quantities are used for linings, and other purposes for which the coarser kinds of linen were formerly employed.

The lightness, as well as cheapness, of the calicoes, has rendered it a chief article of drees amongst all classes of people, and annihilated the manufacture of many of the lighter kinds of woollen and worsted stuffs, formerly so much in demand. The trade of Halifax, and the surrounding country, which confided almost wholly in such stuffs, has gone entirely to decay, and been replaced by the manufacture of calicoes and other cotton goods; and such are the quantities now manufactured, more especially in the country around Colne, and thence to Bradford, that from 16 to 20,000 pieces are brought weekly to the Manchester market; the produce of those dreeses which adjourn, or are included between these two towns.

To the same improvements in spinning which gave birth to the manufacture of calicoes, we are indebted for that of muffin, a branch not less important to the country than honourable to our pride and industry as manufacturers. For this elegant article of drees all Europe had long been tributary to India, where the manufacture has, through the long lapse of ages, arrived at the greatest perfection. Muffins were first introduced into this country by the East India company, about the year 1670, before which time cambrics and Silk's lams were worn, and such fine linens from Flanders and Germany, as were brought back in exchange for our woollen manufactures of various kinds exported theri in considerable quantities. The manufacture was attempted at Paisley as early as the year 1700. A few looms were employed, but this trade was soon annihilated by the introduction of the goods of India. Eighty years afterwards a more successful rivalship commenced. British muffins were first successfully introduced in the year 1781, but were carried to no great extent till 1785, since which period their progress has been rapid beyond all example. In the year 1787, it was computed, that not less than 500,000 pieces of muffin, including frocks and handkerchiefs, were annually made in Great Britain. The manufacture has, from that time to the present, continued progressively to increase and improve, and bids fair to become the most lucrative and extensive of any in this country. The rapidity with which it approaches to perfection, and its surprising extent in the short space of twenty years, are amongst the many important consequences that have resulted from the improvements in the art of spinning.

By the cheapness and superior quality of our yarn, we are enabled to employ thousands of looms in the production of this elegant and useful article of drees, to keep in this country millions of specie which was heretofore sent to the East to purchase this commodity, and to clothe ourselves with this fabric at one-third of the expense formerly required. The demand for, and the use of this article, are proportionate to its cheapness and elegance, and it is not difficult to see that it will become a staple manufacture of this country.

Glasgow and Paisley in Scotland, and Bolton in Lancashire, are the chief seats of this manufacture, which is however considerably extended over many other parts of the country. India still maintains her superiority in the finer kinds of muffin, some of which of most exquisite beauty and finesse are sold in this country, as high as ten or twelve guineas per yard. In productions like these, no rivalship can exist; in India they are looked on as matter pieces of art, and the time employed by an Indian weaver in their production would ruin an European.

The common kinds, or such as are more adapted to general use, are also preferred by our English ladies to those of home manufacture, on the score of their enduring greater hardships and retaining their colour, or rather whiteness, better. This excellence, which exists to a certain degree, is the result of no superiority in the manufacturing processes, but in the raw material, of which that of India is the finest and best in the world.

Muffins were manufactured at Zürich and St. Gall in Switzerland long before we succeeded, yet such were the advantages which the improvements in spinning afforded us, that till within these few years (during which the unsettled state of the continent has interrupted, and in some countries annihilated, all commercial intercourse) we supplied all Europe with muffins, not only of Indian, but British manufacture.

Nankeens and ginghangs were manufactures, which, without the improvements of the spinner, could not possibly have succeeded.

These articles, like the two preceding, were formerly brought from the East exclusively. Fustians, dimitys, jeans, quiltings, velvets, velverets, velveteens, and a variety of cotton goods, which the limits of our article will not allow us to particularize, have been improved to such a pitch, that Manchester has supplied all Europe with these fabrics.

Cotton hosiery forms no inconsiderable part of this immense manufacture, and it was the demand for cotton thread for the flocking weavers, that urged forward the improvements of Mr. Arkwright, and held out such strong inducements to their whole assistance first enabled him to give his invention to the world.

Exclusive of these various manufactures, great quantities of twill were exported to the continent, and a considerable part of the yarn spun in Manchester, before the late disastrous occurrences in Germany, was employed in the foreign loom. It was this demand for twill, which our continental rivals were unable to produce of equal quality
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or price with ours, which raised this branch of the cotton manufacture to a state of prosperity, of which some idea may be formed, when it is stated that the various establishments for spinning only in this country, when in full activity, give employment to near 180,000 persons, a number little short of that which is employed in France in all the different branches of the cotton manufacture together, and which, according to the report of Chapital, late minister of the Interior, amounts to near 200,000.

The value of these improvements in spinning was so obvious and so important, that it is not surprising they were soon diffused over the continent, notwithstanding every precaution used to prevent it. By the emigration of mechanics, and the clandestine exportation of machinery contrived here, our neighbours soon became possessed of our improvements, and had we paused in our exertions, the superiority we had acquired would long ere this have passed away. France, as we have just observed, has a great population employed in the manufacture of cotton. Prussia and Germany have many and increasing establishments, and in the two former countries, and in the hereditary dominions of the emperor of Germany, our piece goods have been long prohibited.

Our spinners however, by their ingenuity, and the improvement and perfection of their machines, have still kept the lead; and the attention of our manufacturers is now directed to the perfection of these operations more immediately connected with the labours of the loom, in which, till within these few years, little has been done. Every day brings forth new discoveries, and it is not difficult to see that what has already been achieved, and what, from the general spirit of improvement which is now abroad, must inevitably follow, will soon place us far beyond the reach of competition in the manufacture of cotton goods, and give us advantages greater than ever we enjoyed since its first establishment in this country. Before we enter into such a detail of these improvements however, as will enable our readers fully to comprehend their nature and extent, it will be proper to take a short view of the different operations and processes through which the thread passes in its progress from the hands of the spinner to the loom.

The thread is of two kinds, viz. twist, so called from its being harder twisted than the other, forming a Router thread, and used for the web or warp of piece goods, and woof, which is a looser, softer thread, and used for the woof. The twist is delivered to the weaver in small oblong rolls called cop; in the flax they are stripped off the spindles of the mule or Jenny. When these are used, a small pointed piece of wood or skewer is carefully passed through the axis of the cop into the place formerly occupied by the spindle, and one end of it being held between the teeth, the thread is wound off the cop upon the weaver’s bobbin by a wheel somewhat smaller in fixe, but the same in principle as the common one thread wheel on which all the spinning was formerly performed.

This is generally done by children, and the bobbins are then ready for the shuttle. Twill undergoes several operations before it is ready for the loom. It is delivered by the spinner either in bank or cop.

Hank twist is that which is spun on the water frame, from the bobbins of which it is reeled into banks of a determinate length, each measuring 840 yards. The value and fineness of the thread are proportionate to the number of banks in a pound, and they are denominated by numbers, as Nos. 25, 50, 100, &c., which express the number of hanks which a pound of twist contains. In this state it is generally fixed, an operation which is intended to give additional strength and tenacity to the thread, and enable it to support the different operations in its passage to the loom. It consists in impregnating the thread fully with thick size, chiefly formed of wheat flour boiled in water, with the addition of a little glue. The twist is carefully worked in this and afterwards wrung and dried. The thread acquires considerable strength by this operation, and the loose fibres are all firmly attached or glued to its surface. It is then delivered to the winder.

Winding is that operation by which the thread is transferred to the warping bobbin, either from the cop, bank, or twist frame bobbin.

Formerly this was chiefly done by females, and the work was carried home and performed by any of the family not engaged in domestic concerns, on a small wheel that turned two bobbins at a time.

This mode is still in use, but the work has been greatly abridged and facilitated by the use of machines of various constructions, for a description of which, see MACHINE.

Cop twist is that which is spun on the mule or Jenny. It is reeled only occasionally to ascertain its value and fineness, and is delivered in cops to the winder.

The next operation is that of warping, or the formation of the web. The machine on which this is performed is an octagonal prism five or six feet high, and somewhat less in diameter, revolving vertically, and put in motion by a band and pulley placed under the seat of the warper. The bobbins which furnish the thread are suspended horizontally in a frame on one side. Twenty-eight or thirty threads, forming together a system called a half beer, are wound round the prism in a spiral form from top to bottom. The machine is then turned the contrary way, and the thread wound round the prism upwards from bottom to top, and this is repeated backwards and forwards till a sufficient number of half beers have been wound to form a web of the breadth required.

When finished, and the ends properly secured, the whole is wound off and coiled upon the hand into a round ball called the warp. For further particulars of this operation, and a description of the machine, see MACHINE.

When the thread has been previously fixed in the bank, it is now ready for the loom, but if the warp is made of cop twist, that operation is next performed.

The warps are boiled several hours in water till they are thoroughly penetrated and softened; after draining some time they are then uncoiled and worked in the size till fully impregnated, after which the superfluous size is squeezed out, and they are suspended on poles to dry; the warp is then ready for the loom.

Without this operation of sizing, which, as we have before observed, gives strength and tenacity to the thread, it would not support the friction of the loom. Two threads are passed between each dent of the reed, and at each stroke of the treadle one ascends whilst the other descends. There is therefore a violent friction of the threads upon each other, as well as against the teeth of the reed. The motion of the reed itself also backwards and forwards, and of the healds up and down, is very severe upon the warp, and unless it has been well penetrated by the size, and its fibres well cemented or glued together, this continual rubbing is sufficient to destroy its texture.

Good sizing prevents this, but it is further aided by another operation called dressing, which is performed by the weaver himself after the warp is got into the loom. This consists first in applying with a brush a kind of pale made
of wheat flour well boiled, to which is often added a small portion of common salt; sometimes of potash, and sometimes even a little tallow.

It is in fact a repetition of the operation of sizing, with this difference, that the dressing is applied chiefly to the surface of the thread, which is slightly firmed with the pail, and brushed uniformly in one direction from the healds to the beam, by which means the loose fibres are all dis- posed evenly one way, and firmly glued fast to the thread.

In summer the warp is dried simply by fanning it, but in winter, and in damp cold weather, a hot iron is lightly passed over it. It is then dressed again with a brush dipped in tallow or butter, with which it is slightly greased. This gives sharpness and smoothness to the thread, and greatly diminishes the friction of the healds and reed. As such a portion of the warp as is extended between the healds and beam can alone be dressed at one time, this is woven, and the dressing repeated again upon another portion, and so on alternately dressing and weaving till the whole of the web is finished.

Various improvements on these different processes have taken place during the last six or eight years, which have made greater or less progress in proportion to their importance. We shall enumerate, therefore, not only those of recent date, but such as, though known some time, have not been generally adopted.

The weaver's bobbin is still wound by hand in the manner already described, though the use of a small machine, by which twenty bobbins or upwards are wound at once, is daily gaining ground. They are to be seen now in almost every weaver's cottage where several looms are employed. This labour is further abridged by a very ingenious contrivance for which a patent has been obtained. The cops, instead of being wound, are compressed or squeezed till they are small enough to enter the shuttle. The winding here is done away, and the cops thus compressed are preferred, by the weavers to the common bobbin. In those large establishments where the different processes, such as spinning and weaving, are carried on together, the cops are from small enough to enter the shuttle without compression. The weft is transferred at once from the spindle of the mule to the weaver's shuttle, and the time and waste of winding, and even of compressing, saved entirely.

On the same principle also, a considerable reduction has been made in the labour of reeling and winding twist. Till within a late period, the practice has uniformly been to reel it into bobs from the bobbin it is with on, to fix it in the hank, and then wind it for winding. An obvious reduction of this labour is to wind it directly from the bobbin it is from on, and fix it in the warp like cop twist. For reasons, however, which it will not be necessary here to enter into, this has been found impracticable. It is, however, transferred to the warping bobbin without the intermediate labour of warp of reeling, and the fixing is done in the warp.

Considerable improvements in the mode of sizing have been made in these few years, especially in the sizing of warps.

Formerly, the practice was to work the warp in the warm size by the hand, the heat of which was of coarse to that degree which could be readily borne by the workman. Experience having proved that the hotter the size, the more evenly and perfectly was the warp penetrated, varnishers were adopted for applying it at a high temperature. Amongst others are oblong troughs furnished with several pairs of rollers, through which the warp passes, and is strongly compressed whilst immersed in the hot size.

Mr. Marland's idea of placing the twist as an exhausted receiver, and admitting the hot size, promises considerable advantages in some cases, and when the plan has been matured, will no doubt be susceptible of many applications.

But the greatest improvement that has been made in these different processes, and one that must eventually affect a complete revolution in the whole system, is Meffs. Ratcliffe and Rofs's mode of dressing. Hitherto this operation has been performed by the weaver in the manner we have already described, at the expense of one-third of his time and labour. As it is only possible for him to dress at once as much of the work as is contained between the healds and beam, he is fearfully set to his work, after each operation, before he is again called off to dress another portion. By this continual interruption of one species of labour by another totally different, it must be obvious to every one, that not only much time is lost, but that the labour itself cannot be equally well performed.

There is a delicacy and certainty of touch in weaving, dependant on long habit and experience, and on which the evenness and good deal of the cloth depends.

If the force with which the woof or weft is driven up by the reed, be not always alike, if it is greater at one time and less at another, the cloth will be thicker and thinner at those places, and such is the nicety on which this depends, that the most experienced weaver, after an interruption of some hours, cannot at once regain it.

Meffs. Ratcliffe and Rofs dress the whole of the warp before it is wound upon the beam, the labour of the weaver is therefore uninterrupted, and his attention directed firmly to one object. This alone is a great point gained, but it is attended also by other, not less important, advantages. Great part of the intellectual skill required in weaving is in the dressing and beaming of the warp; the mere mechanical part of throwing the shuttle, &c. is soon acquired, even by a boy. A more accurate division of labour, by reducing the beaming and dressing to a systern by which they are better, more economically, and more expeditiously performed than before, has removed the great difficulty in the art of weaving, and rendered it in a great measure the employment of children.

From what we have already said, it will appear that the object in dressing and sizing is nearly the same, and Meffs. Ratcliffe and Rofs, by this improved mode of dressing, have succeeded in reducing those operations to one. They have gone still further; they have done away the necessity of warping, by forming the web at once from the bobbin, and thus reduced the warping, sizing, dressing, and beaming, to one operation. A thousand bobbins and upwards supply the materials for the warp, which in its progress is properly disposed and arranged, sized, dressed, and finally wound upon the beam. This improvement, which may justly be regarded as the most important that has taken place in weaving since the invention of the fly shuttle fifty years ago, must in the end effect a complete change in the systern of labour. Great however as its advantages are, some time must necessarily elapse before it can be accommodated to general use. In large establishments, where the different processes of the manufacture are carried on together, such as spinning, weaving, and the labour immediately connected with them, it has been adopted with the happiest success, but the weaving in this country is chiefly done in the cottages of the poor, and to their use the costly and erry apparatus of Meffs. Ratcliffe and Rofs is not adapted.

To derive all the advantages possible from this improvement, therefore, it will be necessary either that the weaving be
be done in large loops, to each of which a dressing machine may be attached, or that the warps be delivered to the country weavers ready dressed and wound upon the beam. The former plan is daily gaining ground, and perhaps it is not difficult to foresee, that at no very distant period all the weaving of the country will share the fate of the spinning, and quit the cottage for those larger establishments in which it will be susceptible of better management, and more accurate division of labour.

The last improvement, which we shall notice in the manufacture of cotton, and which, when once established, will complete what Arkwright has so happily begun, is that of weaving by machinery. Various attempts have been made of late years to apply the great moving powers, steam, and water, to the common loom. Mr. Dolignon, many years ago, constructed a loom adapted, as we are told, to the manufacture of all kinds of cloth. It might be wrought by the power of wind, water, steam, or animal strength, and possessed an infinite capacity (if we may be allowed the phrase) of knowing when any thread of the weft or warp was broken, in which case the loom ceased its motion, thus calling on the attendant to repair the damage, which being done, it immediately went back to its former track; few of these looms might be attended with ease by a girl of sixteen, or an aged or infirm person of both sexes. The inventor did not live to reap the fruit of his labour, nor to introduce his machine properly to the world. He died soon after its completion, and the loom was not completed at the time he died, the work being left to others to finish it.

Mr. Auffin of Glasgow who has produced one, a model of which is deposited at the house of the Society of Arts in the Adelphi, in favour of which numerous testimonies were transmitted to the secretary. In the year 1798, a loom on this construction was set to work at Mr. Monteith's spinning works near Glasgow, which answered the purpose so well, that a building was erected by Mr. Monteith for containing thirty looms, and afterwards another to hold about 200.

The model deposited in the Adelphi is an improvement on the first made for Mr. Monteith, whose name we do not otherwise see amongst the list of those who bear testimony to its value. A loom of this kind, says the inventor, occupies only the same space as a common loom. Its excellence is about one-half more. The reeling, winding, warping, dressing, loom, dressing, framing, dressing, drawing bares, shifting locker, rods, and temples, which are nearly one-half of the weaver's work, together with the general work accompanying them, all which occur in the operation of the common loom, do not happen in this, which by its single motion, without trouble, performs every operation after the spinning, till the making of the cloth is accomplished. One weaver and a boy are sufficient to manage five looms of coarse work, and three or four of fine work. The construction of this loom is so complicated, that the society have not, in their Transactions, given the public a drawing of it, conceiving that a model only could render it intelligible.

Other looms of a more simple, and consequently of more useful construction, have been invented by Mr. Harris, Horrocks and Marland of Stockport near Manchester, which, combined with the dressing machine of Messrs. Hartcliffe and Rofes, promise to be of considerable utility, and have already been tried on a sufficiently extensive scale by the inventors. The dressing machine, indeed, has removed the great difficulties in machine weaving, and without it nothing important or advantageous could have been accomplished. It has also rendered the machine loom itself of less importance, by simplifying the art of weaving so much as to render the employment of boys, which was formerly entrusted only to experienced weavers. To the rapid extension of this improvement, however, there are objections at the present moment arising from moral as well as political considerations which must greatly retard its progress, and we must look to happier times for the proof of its general utility, and its final adoption or rejection.

The preceding sketch, short and imperfect as it is, will serve to convey some idea of the immense and important manufacture. Of the population at present engaged in it, and of its annual value, we have only such conjectures to offer as are founded on those materials which are within the reach of individuals, and unless government order such an enquiry, it can only be estimated by the importation of cotton, which is for the most part manufactured at home.

Perhaps the manufacture of Scotland, as being in a narrow field, is more within the reach of observation than that of England; we therefore venture to lay before our readers, as being apparently an approximation to the truth, the following:

Estimate of the state of the cotton manufacture in Scotland, made up in the year 1796 at Glasgow, the centre of the principal commerce and manufactories of that kingdom.

<table>
<thead>
<tr>
<th>Water Mills</th>
<th>39</th>
<th>Each</th>
<th>£390,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings and Work</td>
<td>154,800 spindles</td>
<td>£7,200</td>
<td></td>
</tr>
<tr>
<td>1200 Jennies 84fp each</td>
<td>100,800 at 6/each</td>
<td>600 Jennies 144fp each</td>
<td>86,400 at 30/each</td>
</tr>
<tr>
<td>Total, working by day and night</td>
<td>312,000 spindles</td>
<td>£75,000</td>
<td></td>
</tr>
<tr>
<td>Capital vested in machinery and buildings</td>
<td>£490,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The yarn annually spun is valued at</td>
<td>£1,256,412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cotton 4,629,043 lbs, average value 22</td>
<td>£462,004</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The people employed are estimated at 25,000 of both sexes, young and old, but the greater part under 15 years of age, whose labour, aided by machinery, thus improves the value of the raw material in the first stage of manufacture.

From which deduct wages estimated at 500,000

| Remains for rent, and wear and tear of machinery, and proprietors' profits, the sum of | £293,508 |

The annual value of calicoes and muslins, now devotedly esteemed the staple of Scotland, when finished, including the excise duty on a part of them which are printed, and the cost of tanning and needle work on about a third part of them, was then estimated at £3,108,549 above.

Yarn got from England. 520,000

£1,776,412

The
COTTON.

The wages of weavers, tambourers, needleworkers, the charges, the profits of the manufacturers, and the revenue paid to government, thus amounted to £1,533,137, which great sum is produced by capital, ingenuity, management, and labour in the subsequent stages of the business.

The cotton manufacture in Scotland employs 38,815 weavers, 12,938 women, and supposing 7 of the muslin adornment with needle work 105,000 women, and girls most children.

Besides those employed in the spinning branch 25,000

Hence it appears that 181,753 persons derive their immediate subsistence from the cotton manufacture in Scotland, and also a proportional number in England, employed in producing yarn to the value of 520,000/; besides the innumerable people of all classes concerned in providing necessaries and accommodations of every kind for that great multitude, and in constructing and repairing the machinery and buildings; and the cultivators of the cotton in the East and West Indies, seamen, merchants, &c. who are all wholly or partly supported by this most beneficial manufacture, by which the cotton is raised, taking the whole manufacture together, to about seven times the value it was of when imported.

The cotton manufacture has increased very much in Scotland since the year 1796. The imports of cotton into the kingdom in the year 1800, were nearly treble those of the year 1796. The printing business however appears to have declined a little, as may be inferred from the following

Account of the Calicoes, Muslins, Linens, and Stuffes, printed in Scotland in the years 1796 and 1800.

<table>
<thead>
<tr>
<th></th>
<th>1796 Yards</th>
<th>Amount of Duty</th>
<th>1800 Yards</th>
<th>Amount of Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate of Duty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Calicoes and Muslins</td>
<td>141,403</td>
<td>4,124 5 1</td>
<td>78,868</td>
<td>2,300 6 4</td>
</tr>
<tr>
<td>British Calicoes and Muslins</td>
<td>4,258,567</td>
<td>62,103 19 1½</td>
<td>4,176,039</td>
<td>60,913 13 10 ½</td>
</tr>
<tr>
<td>Linens and Stuffes</td>
<td>1,85,500</td>
<td>17,288 10 10</td>
<td>1,220,714</td>
<td>17,802 1 7</td>
</tr>
</tbody>
</table>

In England and Wales, on the contrary, the printing business has increased during the above period, as will appear from the following

Account of the Calicoes, Muslins, Linens, and Stuffes, printed in England and Wales in the years 1796 and 1800.

<table>
<thead>
<tr>
<th></th>
<th>1796</th>
<th>Amount of Duty</th>
<th>1800</th>
<th>Amount of Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate of Duty</td>
<td>Yards</td>
<td></td>
<td>Yards</td>
</tr>
<tr>
<td>Foreign Calicoes and Muslins</td>
<td>1,750,270</td>
<td>51,840 10 10</td>
<td>1,572,530</td>
<td>46,611 9 4</td>
</tr>
<tr>
<td>British Calicoes and Muslins</td>
<td>4,435,420</td>
<td>335,897 5 0</td>
<td>3,894,790</td>
<td>418,436 10 5</td>
</tr>
<tr>
<td>Linens and Stuffes</td>
<td>3,64,862</td>
<td>50,529 4 11</td>
<td>3,232,078</td>
<td>47,134 7 11</td>
</tr>
</tbody>
</table>

If we follow the calculation assumed in an estimate laid before a committee of the house of commons, that the duty is one tenth of the value, we may estimate the value of the British calicoes and muslins printed in England and Wales in 1796, at £3,059,972 0 0, and those in 1800 at £4,184,365 0 0.

From these statements, which are official, it appears that in 1800 there were printed about a million and a half of calicoes and muslins in Great Britain, exclusive of linens, stuffs, and foreign calicoes. From that time, to the year 1805, the business has continued progressively to increase, the amount of duties on printed goods for that year being upwards of 600,000/., which will bring the number of pieces printed nearly to two millions.

The quantity of white calicoes and muslins made in England and Wales, is certainly much greater than that of the printed; probably not less than three million pieces annually.

From the signatures to the petition of the journeymen calico-printers to the house of commons in the year 1806, it would appear that, in Great Britain and Ireland, the number is 7000; we suppose however that this number includes apprentices, and that the list also has been swell'd, as is usual in such cases, by unfair means.

During
During the progress of the work we shall have frequent opportunities of revert[ing] again to the subject of the cotton manufacture, and of supplying those omissions which, in a business of such magnitude and extent, when submitted to individual investigation, must unavoidably occur. We shall conclude therefore with observing that, from the best information we have been able to collect, and from calculations founded on the quantity of the raw material imported into the country and of goods exported, it appears that the cotton manufacture of these realms gives employment to 800,000 persons, and that its annual value is upwards of 30 millions.
COTTON MANUFACTURE.
ROVING CANN FRAME.

A. Roller beam.
b. Front roller.
c. Back Dc.
d. Top front roller.
C. Revolving cam.
W. Roller weights.
P. Gun pulley.
DD. Back cam.
E. Driving pulley.
F. Loose pulley.
NS. Gun stand.
L. Cleaver.
p. Front roller pulley.
F. F. Bobbins.
COTTON MANUFACTURE

ROVING FRAME, Plate 1st.

These cans contain the slivers brought from the drawing frame.

Horizontal Plan of the Machine called Double Speeder.

Published as the Act directs, 1814 by Longman, Hurst, Brown & Rogers, Paternoster Row.

Engraved by Wilson Lowry.
COTTON MANUFACTURE.

ROVING FRAME termed DOUBLE SPEEDER.

Fig. 1. Elevation in Front.

Fig. 2 & 3.

Published as the Act directs, 1815, by Longman, Hurst, Rees, Orme & Brown, Paternoster Row.

Engraved by Wilson Lowry.
Cotton Manufacture.

Reeling.

Fig. 1.

Fig. 2.

Machine for winding sewing cotton into Balls.

Fig. 3.

Fig. 5.
COTTON MANUFACTURE.

Fig. 1. DOUBLING MACHINE.

Fig. 2.

TWISTING MACHINE.

End View. Fig. 3.

Elevation. Fig. 4.