with cares for which he is unable to provide, and which subject him to labour as a stern necessity; in the other with surplus enough to enable him to oppose arrogant demands, and with a mind trained to examine and decide upon his best interests. We are aware that argument of this sort is met by the common cant, that the rich are not willing to permit the poor to indulge in the enjoyments so eagerly sought by themselves; and that the desire of employers is to restrict the happiness of the employed; but we are not to be deterred from the truth by such fallacies or false testimony. Were the accumulation of wealth the sole object of the already wealthy, their most direct means would be the encouragement of improvidence among the labourers: inasmuch as it would place these more directly and inevitably in their power. On the other hand, habits of providence and economy would put within the labourer's power the means of living in real independence of the capitalist's employment; or, in the event of a dispute, to engage in business on his own account. He would thus be really strong; and being in a position to withhold his labour for a time from the market he must of necessity be enabled to dispose of it to greater advantage to himself, without at all interfering with the rights or good order of the community.

But the agrarian spirit, unhappily too rife in this country, if it were permitted its sway, must speedily root up the foundations not alone of our prosperity, but of our whole system of liberty and laws; and to none could it prove more injurious than to those who imagine their great advantage lies to themselves in the change. That portion of freedom and property which is yielded in exchange for the protection of law and the preservation of order, redounds most forcibly to the advantage of those who apparently have the least at stake. The wealthy, and otherwise powerful, have or may create means of resistance to popular or individual rapacity; they may gather friends or hire mercenaries; but these means of protection are not within the compass of the small possessor. And in all turbulent or violent changes, the greatest miseries have been undergone by the poor and weak: while, on the other hand, under the steady operation of orderly systems, they have been gradually advancing in comfort and consideration.

That there are objections the other way, and in this country, it would be utterly vain to deny. That the improvidence and recklessness of labour have placed an inordinate amount of power in the hands of capitalists, ever too ready to accumulate in heavy masses; and that capital has made haste to swell its coffers, reckless of every other consideration, there is too much cause to fear; yet this furnishes no sufficient ground for any attempt to disturb the orderly operation of the system. The best counterpoise is in the hands of those who have most to dread; and if they would but use judiciously the means within their reach, they might essentially retard that too rapid march to excess and corruption so much opposed to "the greatest good of the greatest number."

It must be confessed, however, that there is small hope to cheer the true philanthropist, so long as the present defective and injurious education prevails; and especially while we continue the importation of foreign ignorance and agitation principles. Better views must be imparted to the labourer than he can obtain from Trades Union lectures, or the orations thundered forth at "strike" meetings. In place of considering the man who has husbanded the proceeds of his labour for himself or his children as a common robber

of the human family, such must be considered as the true benefactors of the race; in as much as in no case could mankind have been in the enjoyment of the comforts by which they are now surrounded, were it not for the savings thus accumulated.

Upon the relative advantages possessed by England, France, and the United States of America, as manufacturing nations. By Z. Allen.

"The following table will give a comparative view of some of the most important advantages possessed by three of the principal manufacturing nations of the earth to manufacture at the cheapest rates. The price of labour forms the most important particular; but the superior skill of the labourers, and the improved machinery employed by them, must be taken into consideration, as well as the facilities of obtaining water or steam power. In respect to water power, the United States possess eminent advantages over most other countries. France abounds in fine mill streams; but in some of the principal manufacturing districts of that country, steam engines are from necessity frequently employed for operating machinery. In England the water power, although of inconsiderable amount compared to the steam power in use there, is highly improved wherever available in the manufacturing districts. It is probably attributable to the abundance and cheapness of water power, that the manufacturers of the United States are enabled to compete successfully with England and France in the production of such fabrics as require the application of a considerable moving force, notwithstanding the lower rates of labour in these two countries. With the several relative advantages possessed by England and by the United States, the rivalship between the two countries in manufactures is probably destined to continue long, and to be intensely interesting to the destinies of thousands of industrious artisans, when the manufacturers of the United States shall more generally extend their competition to supplying the markets of various foreign countries with some of the products of industry now furnished from England. Already has the competition been commenced and successfully maintained by the Americans, in supplying the markets of South America with coarse cottons, and with many other manufactured articles. Even the Hindoo labouring at his loom for a few cents per day, and subsisting upon a handful of rice for his daily fare, has been compelled to yield to the superior skill and machinery of the American manufacturers, whose fabrics have already been transported for sale to the distant markets of Calcutta and Canton.

"This table will also give an idea of the relative comforts which the labourers in these several countries can enjoy as the fruits of their toil. In France much less, and in the United States comparatively little, is exacted from the labourer by taxes upon the necessaries of life. For this reason a labourer in the United States, although he should receive only the same nominal amount of wages, possesses an advantage of more than twenty-five per cent. over a fellow labourer in England, from the circumstance of the comparative cheapness of almost every article which he requires for his own use or for that of his family.

Comparative Table of the average price of Labour in England, France, and the United States of America.

	England.	France.	United States.
	s. d. *d. c.*	*francs* *cts.*	*dols.* *cts.*
A common day labourer earns per day	3.0 stg.= 74	about 2. 37 to 40	about 1.00
A Carpenter	4.0 " 97	" 3 to 4. 55 " 75	" 1.45
A Mason	4.6 " 1.10	" 3½ to 4½ 60 " 80	" 1.62
A Farm Labourer (per month and found)	27.0 " 6.50	" 400 " 600	" 8.00 to 10.00
A Servant maid (per week and found)	2.9 " 67	" "	" 1.00 to 1.50
Best Machine Makers, Forgers, &c. per day	8.0 " 1.94	" "	" 1.50 to 1.75
Ordinary " " "	4.6 " 1.10	" 5. " 92	" 1.25 to 1.42
Common Mule Spinners in Cotton Mills	4.2 " 1.02	" 80 " 90	" 1.08 to 1.40
" " Woollen Mills	3.10" 94	" 40 " 50	" 1.08
Weavers on hand looms	3.0 " 74	" 37 " 50	" .90
Boys 10 or 12 years of age do. per week	5.6 " 1.30	" 85 " 100	" 1.50
Women in Cotton Mills per week, average	8.0 " 1.96	" 148 " 200	" 2.00 to 3.00
Do. Woollen Mills " "	8.0 " 1.96	" " 150	" 2.50
In Holland a day labourer earns about 35 cents			
" Carpenters and Masons " 60 "			
" Ship Carpenters " 80 "			N. York. Pittsburgh.
Average price of Wheat per bushel in 1827	7.4 " 1.79	" " 117	96 cts. 49 cts.
" price of good coals for steam engines per ton	9.0 " 2.20	" ‡ 600 " 700	700 " 106 "

* This table was formed with great care from the result of personal enquiries made in the most important manufacturing districts of England and France, and the prices are taken at an average, as nearly as practicable. Since the year 1825, at which period these notes were taken, there have been considerable fluctuations in the price of labour in England, resulting probably in a general depreciation of wages. The value of the Spanish dollar is estimated at about 4 shillings 1½ penny Stg. when the exchange between England and the United States is 10 per cent. in favour of the former country, making the shilling sterling about 24½ cents. The Spanish dollar is not a current circulating coin in England, and has no standard value in that country; but is bought and sold as bullion. By a statute law of the U. States the Spanish dollar was made a standard coin for the currency of the country, and was arbitrarily rated at the value of 4s. 6d. stg. for the purpose of assessing the duties upon all articles imported from England, and paying a certain impost upon the first cost. By thus underrating the value of the sterling currency, the American duties on English manufactures are in effect reduced about 10 per cent.

† In Manchester.

‡ Near Louviers and Paris.

"From a view of the preceding table it appears that the average wages of persons engaged in manufacturing operations are nearly twenty per cent. cheaper in France than in England, and about eighteen or twenty per cent. cheaper in England than in the United States. Notwithstanding the difference in the prices paid for the same descriptions of labour in France and in England, judging from the observations which I have had opportunities of making, it would appear that the superior skill of the English operatives, and the improved machinery generally employed by them, yield so much greater products as nearly to equalise the difference in the cost of labour; and the two countries may be therefore considered as possessing nearly equal facilities for manufacturing cheaply, so far as labour is concerned. For instance, one man with the aid of two girls and a boy I have seen operating with the greatest apparent ease about seven hundred mule spindles in England; whilst in the same month I have seen in Lille, in France, two Frenchmen exerting their utmost force to turn by their manual labour the crank of a single mule of only two hundred spindles, with a boy to assist in piecing the threads. Very many of the French mills are operated by horses, which may be frequently observed traversing in their monotonous circle beneath the vaulted arches of old gothic cathedrals and monasteries, which have been converted into manufactories. The clustered pillars and sculptured stone work of these venerable structures form a strange contrast with the bright colours of the painted machinery, the perpetual din of which scarcely allows the spectator to muse upon the change that has taken place since the period when the silence that reigned within these walls was only broken by the chant of the matin and vesper anthem. Although the machinery of the French mills is generally put in motion by water or steam power, and the most improved English machines are introduced into them, yet there is a most apparent difference in the manufacturing enterprise of the inhabitants of the two countries. In the best cotton mills near Rouen and Paris, intelligent English mechanics are generally to be found aiding or directing the operations. In those branches of business in which the taste of the artist contributes to the value as much as his skill, the French appear to excel their English neighbours. This is particularly observable in the articles of jewelry exhibited at the glittering shop windows of the Palais Royal, and also in various branches of the silk manufacture.

"In respect to general information the French and Flemish mechanics appear to be deficient, their enterprise and industry having been for many years paralysed and interrupted by the continental wars of Europe. Since the arts of peace have gained the attention of the governments of Europe, and been sustained by them with fostering care, the mechanical arts have made more rapid advances. There still exists a languid indifference and want of information in relation to the progress of improvements made in other countries.*

* On my way from Brussels to Haerlem to view the national exhibition of the manufactures of Belgium, holden under the auspices of the king and honoured by his presiding at the distribution of the prizes, having accidentally fallen into company in a diligence with a Flemish artist on his way to the same place with some of his new machines, our conversation turned upon the subject of steam navigation, then lately introduced into that country. He enquired if there were any steamboats in America, and was surprised on being informed that they had been in successful operation there

"To the effects of a republican form of government existing in the United States it may be attributed (if the writer be not blinded by a partiality for the free institutions of his country) that a spirit of commercial enterprise and of manufacturing interest prevails, unequaled in any other country. There is in the United States no ennobled order of men, and lofty pride of ancestry, to render the manufacturer or merchant half ashamed of his profession; and no burthensome system of taxation to depress the mechanic, and to circumscribe his scanty means to gaining a mere subsistence. From the habits of early life and the diffusion of knowledge by means of free schools, there exists generally among the mechanics of New England a vivacity in enquiring into the first principles of the science to which they are practically devoted. They thus frequently acquire a theoretical knowledge of the processes of the useful arts, which the English labourers may commonly be found to possess after a long apprenticeship and life of patient toil. For this reason the American mechanic appears generally more prone to invent new plans and machines than to operate upon old ones in the most perfect manner. The English mechanic, on the contrary, confining his attention simply to the immediate performance of the process of art to which he is habituated from early youth, acquires wonderful dexterity and skill. One of these labourers was pointed out to me by the proprietor of an English manufactory as having occupied for nearly thirty years the same spot by the side of his machine, or rather machines—the materials of brass and steel of a succession of them having failed and worn out under his inspection. The constant tread of his feet during this long period had channelled furrows in the very floors, and every motion of his body appeared almost as mechanical as if he had become a machine himself. Without information on any other branch of business, such a man, when thrown out of his accustomed employment by the vicissitudes which must at times attend the affairs of a manufacturing as well as of a commercial people, is usually left helpless and

nearly twenty years. I took occasion to describe to him several American inventions, among others the machine for cutting and heading nails, which were completely finished and fall off from the engine as fast as one can count them. The machine for making weavers' reeds or slaies seemed to strike attention as a wonderful invention, whereby the mechanism is made to draw in the flattened wire from a reel, to insert it between the side pieces, to cut it off at the proper length, and finally to bind each dent firmly in its place with tarred twine, accomplishing the whole operation without the assistance of the attendant, in a more perfect manner than can be performed by the most skilful hand. Although he possessed a good share of intelligence, the complicated operations of these machines, performing processes which he supposed could only be brought about by manual dexterity, appeared to him incomprehensible. But when I proceeded to describe Blanchard's lathe in which gun stocks and shoe lasts are turned exactly to a pattern, his belief seemed somewhat wavering, and on continuing to give him a description of Whitmore's celebrated card machine, which draws off the card wire from the reel, cuts it off at a proper length for the teeth, bends it into the form of a staple, punctures the holes in the leather, and inserts the staples of wire into the punctures, and finally crooks the teeth to the desired form—performing all these operations with regularity without the assistance of the human hand to guide or direct it, the credulity of my traveling companion in the diligence would extend no farther, and he evidently began to doubt all the statements I had been making to him, manifesting at the same time some little feeling of irritation at what he appeared to consider an attempt to impose upon him such marvellous accounts. Uttering an emphatic humph! he threw himself back into the corner of the diligence, and declined further conversation during the remainder of our ride upon the subject of mechanics and of the improvements made in Flemish manufactures.

destitute, unable to turn his hand to other avocations. If a New England man does not succeed in one branch of business he may commonly be found readily essaying some other; even sometimes officiating in the profession of the law or of medicine, after commencing his career with the labours of the plane or anvil. It is undoubtedly true that in very many instances this versatility is attended with a profitless result, as in the present state of the arts and sciences a long period of assiduous labour is required to attain skill and experience in any branch of business. Although many valuable and ingenious inventions in the useful arts have originated in the United States, from which the old* as well as the new world have derived vast benefits, yet it cannot be denied that an incalculable loss of labour and expense in useless experiments has been the result to most of those who have been allured by the delusive search for new inventions and patent rights to deviate from the beaten path. These gropings in the dark for mechanical improvements can in no way be so successfully prevented as by opening the eyes of the mechanic, and causing him to view and examine his schemes more perfectly by the light of science. Some of the extensive manufacturers of Leeds, with a most commendable liberality, have formed small circulating libraries for the use of the persons engaged in their establishments, thus furnishing them with the means of becoming both more intelligent and more virtuous. For this purpose numerous mechanics' libraries have also been instituted throughout England, and the scholars and statesmen of that great and powerful country, with a philanthropy for which "ages yet unborn shall call them blessed," have lent the sanction of their names and the vigorous support of their talents for the general diffusion of useful knowledge. This has been effected, too, on terms so completely within the means of almost every labourer, that it can scarcely be said of the mechanics of the present day, in the words of Gray,

> "That knowledge to their eyes her ample page,
> Rich with the spoils of time, did ne'er unroll."

"England possesses a decided superiority over France and most of the United States in the abundance of coal, and in the consequent advantages afforded by steam power. Notwithstanding, however, the abundance of coal found in England, and the very general use of the steam engine, water power is highly valued in all the manufacturing districts, and mills are erected on streams, which in many instances are sufficient to turn the water wheels, and operate the machinery attached to them, during only a part of the year. Among the mountains of Scotland, however, I noticed numerous fine mill streams which remained unimproved. In Manchester, where coals are as cheap as in most of the manufacturing districts of England, the total cost of steam power, including all charges, amounts to about 20*l.* per year for each horse power, or at the current value of the Spanish dollar, to very near one hundred dollars per annum, as Mr. J. Dyer of Manchester stated to me. The opportunities of obtaining information on this subject possessed

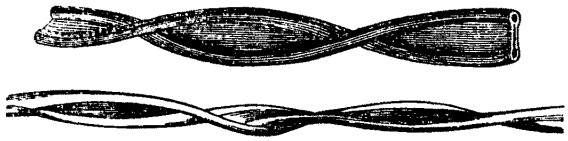
* Of late years England has received more benefits from adopting improvements in the useful arts from the United States, than she has imparted; and the respectful attention of the inhabitants of that country, "illustrious in arts and arms," is now bestowed on the inventive genius of Americans.

by this enterprising American, from a long residence in Manchester, and from being engaged in an extensive branch of manufactures there, has probably enabled him to ascertain this fact with accuracy. The fuel forming the principal part of the expense of operating steam engines, by calculating the cost of coals in England and the United States, a comparative estimate may be formed of the expenses attending the operation of a steam engine in each of the two countries with a tolerable degree of correctness. In the manufacturing districts of France near Rouen, where the most extensive cotton and woollen mills are located, the coals used are brought principally from the mines at Charleroi, and are nearly as dear as in the United States. The coals exported from England to the United States are of a superior quality to those ordinarily consumed for manufacturing purposes, and sell at an advanced price in Liverpool of nearly four shillings per ton, or from fourteen to fifteen shillings sterling per ton. Virginia coal is about equal in quality to the common English coal for the purpose of operating steam engines, and costs on the seaboard of the northern and eastern states three times as much as the coals used in Manchester for steam engines. The daily wages of a fireman and good engineer is nearly as high in England as in the United States. The actual expense necessary for operating a steam engine in England, all other things being equal, may therefore be estimated at rather more than two fifths of what it is on the sea board of the middle and eastern states, when coals are used for fuel; while at Pittsburgh, on the contrary, from the wonderful abundance of coal, steam power is actually available at about three-fourths of the expense required in England. Pine wood seems to be preferred in the United States as fuel for steamboats, from producing a ready and intense heat without being attended with disagreeable sulphureous vapours during combustion.

CHAPTER IX.

GROWTH OF COTTON.

Cotton, as represented by Baines.



Sea Island cotton.

A statement of the Arts and Manufactures of the United States of America, for the year 1810. *Digested and prepared by Tench Coxe, Esquire, of Philadelphia,* 1817.

The capacity of the United States, in the country south of Annapolis, in Maryland, to produce cotton wool, in copious and extensive planters' crops, did not appear, in the year 1786, to have impressed the minds of the people of our own country, even from the thirty-first to the thirty-eighth degree of north latitude. Circumstances, in the family horticulture of the writer, arising among relations resident in Talbot county, had possessed him of the information, that cotton wool was constantly and familiarly raised there, in the little gardening of the children and domestics. It is distinctly remembered, that these impressions of early youth had matured, in the year 1785, into pleasing convictions, that the United States, in its extensive regions south of Anne Arundel and Talbot, would certainly become a great cotton producing country. This expectation was rendered the more deeply interesting, because European inventions of labour-saving machinery, for the carding and spinning of this raw material, were known to the writer to have occurred, though they were, at that time, very imperfectly understood, and not possessed in the United States.

An opportunity was taken, after the convention at Annapolis, in 1786, to examine into the opinions of persons of the highest qualifications, and the best opportunities to judge of the grounds of the suggested capacity for the cotton cultivation, and the connected prospects of those, who might become extensive planters. Mr. Madison was a member of the convention, and on an exami-

nation of the suggestion of our capacity, was immediately and decidedly of opinion, that our success would be certain and great.

The opinions of the best judges, and of those of the most frequent opportunities of observation, were decidedly favourable to the future success of the United States as a cotton producing country. In and before the year 1787, the United States had never exported one bale of domestic cotton to any country: no planter had adopted its cultivation as a crop: nor had we any of those numerous and *invaluable* labour-saving machines, which have been imported and adopted, to card, rove, spin, twist, colour, and print. Such was the real inadvertence, on the part of the intelligent cultivators of the south, to the natural advantages of our soil and climate: such the unacquaintance of the ingenious and energetic mechanicians of the whole Union with the form and value of labour-saving machinery.*

* Cotton has been known to the world, as an useful commmodity, ever since the days of Herodotus; who, upwards of two thousand years ago, wrote that "Glossypium grew in India, which, instead of seed, produced wool." Cotton clothes more of mankind than either wool, flax, hemp, or silk. It has grown for many centuries in the East Indies. It had been declared by Dr. Hewat, in his account of South Carolina, printed in 1719, "that the climate and soil of the province were favourable to the culture of cotton." The first provincial congress in South Carolina, held in January, 1775, recommended to the inhabitants "to raise cotton," yet very little practical attention was paid to their recommendation. A small quantity only was raised for domestic manufactures. The labour-saving machines promoted, greatly promoted, the manufacture of cotton. In this culture the Georgians took the lead. They began to raise it, as an article of export, soon after the peace of 1783. Their success recommended it to their neighbours. The whole quantity exported from Carolina, in any one year, prior to 1795, was inconsiderable, but in that year it amounted to £1,109,653. The cultivation of it has been, ever since, increasing; and in the first year of the present century, eight millions of pounds were exported from South Carolina. So much cotton is now (1809) made, in Carolina and Georgia, that if the whole was manufactured in the United States, it would go far in clothing a great proportion of the inhabitants of the Union; for one labourer can raise as much of this commodity in one season as will afford the raw material for 1,500 yards of common cloth, or a sufficiency for covering 150 persons. It has trebled the price of land suitable to its growth; and when the crop succeeds and the market is favourable, the annual income of those who plant it is double to what it was before the introduction of cotton. Nankeen cotton is cultivated, in the upper country, for domestic use. Mr. Whitney's saw-gin, for the separation of the wool from the seed, has facilitated that operation in the highest degree.

The presence of the raw material will provoke to, excite and produce the manufacture. American cotton will produce a home manufacture. The American will not be uncomfortable in his own cotton velvets, velverets, corduroys, swanskins, and cotton blankets.

Calicoes, or cotton cloths, (unmixed with linen) were first executed in England in 1772. British muslins were first made there in 1781.

Our vast and multiplied water power (1817) unfolds itself daily. A short canal of two miles, in the small county of Philadelphia, by taking the water out of the river Schuylkill, has given us new sites for 140 mills, equal to the turning of 280 mill-stones, to which sites there is good water carriage from the ocean! A packing machine, invented or introduced by Mr. Perkins, formerly of Massachusetts, is said, by the agency of a single person, to effect a pressure which requires the power of fifteen hundred men, and that it can be very much increased. The whole system and power of labour-saving machinery, used in cleaning and manufacturing to the extent of weaving and printing, may be considered as forming, by steam, by water, and by wooden and metallic machinery, a vast body of gigantic *automatons*, in aid of the labour of our people, and the draughts of our cattle. Of this Herculean corps of *automatons*, one of which may work 100,000 spindles, some of our women, our children, with a few men, and our acquired artists are required, as the *little* fingers. We can raise enough exportable surplus cotton for the world upon the fraction of five millions of acres of our sugar, rice, indigo, and cotton country. These strong assertions are no fictions. They are familiar and irrefragable truths.

ORIGIN OF THE SEA ISLAND COTTON.

Mr. Smith.

PHILADELPHIA, December 3, 1830.

Sir,—The original of the annexed letter has been many years in my possession, and was given to me by the gentleman to whom it was addressed. It settles the question as to the source of the Sea Island seed. For want of knowing the native country of the Sea Island cotton, the late Cæsar A. Rodney, upon his return from the mission to South America, by Mr. Monroe actually sent out one or two barrels of the seed to a friend there to improve the staple of the article. I am, respectfully,

JAMES MEASE.

John Cowper, Esq., St. Simon's, Georgia.

HAVANNA, February 2, 1805.

My dear sir,—Being informed by my friend, James Hamilton, of London, that you are the same John Cowper with whom I had the pleasure of being acquainted, many years ago, in St. Augustine, and for whom I have an interest which the lapse of time has not done away, I beg leave, now that I have drawn a little nearer to you, to revive our former friendship. It is pleasing to view the rising prosperity of the land you live in, and particularly

so too when I reflect, that one of the present sources of her riches was, in a very great measure, derived from myself. In the year 1785, disgusted with the Bahama Islands, I settled in Kingston, Jamaica; where, finding my friend, Frank Levett, with his family and all his negroes, in a distressed situation, he applied to me for advice as to what steps he should take, having no employment for his slaves. I advised him to go to Georgia, and settle in some of the out islands and plant provisions, until something better turned up. Being well acquainted with Sapelo, I recommended that island. He could not, he said, bear to live in that country, but as many of his friends were settled in the Bahamas, he would attempt the planting of cotton among them. Being just from thence, I warned him against the attempt, but still he went, and planted cotton. At length, in a doleful letter, he acknowledged himself a convert to my opinion, having found things exactly as I had stated them, and resolved to go to the place I recommended, and there maintain his negroes, until he could look about him.

Early in the year 1786, I sent him a large quantity of various seeds of Jamaica, and as Mr. Moss and Col. Brown requested me to get some of the Pernambuco cotton seed, I also sent to Mr. Levett three large sacks, of which he made no use but by *accident*.*

In a letter to me in the year 1789, he said, "being in want of the sacks, for gathering in my provisions, I shook their contents on the dung-hill, and it happening to be a very wet season, in the spring a multitude of plants covered the place. These I drew out, and transplanted them into two acres of ground, and was highly gratified to find an abundant crop." This encouraged me to plant more. I used all my strength in cleaning and planting, and have succeeded beyond my most sanguine expectations. This year I have every prospect of gathering twenty tons of clean cotton. I am, &c.

PATRICK WALSH.

Extract.—"*Savannah, Dec.* 11, 1788. I have been this year an adventurer, and the first that has attempted it on a large scale in the article of cotton. Several here as well as in Carolina have followed me, and tried the experiment: and it is likely to answer our most sanguine expectations, samples of which I beg leave now to send you, and request you to lay them before the Philadelphia society for encouraging manufactures, that the quality may be inspected into. I shall raise about 5000 pounds in the seed, from about eight acres of land, and next year I intend to plant from fifty to one hundred acres, if suitable encouragement is given; the principal difficulty that arises to us is clearing it from the seed, which I am told they do with great dexterity and ease in Philadelphia with gins and machines made for that purpose. I shall now esteem it a singular favour your procuring me one of those gins, and I will thankfully pay whatever the cost of it may be. I

*Plaster of Paris was introduced near Philadelphia, and its effects discovered by accident.

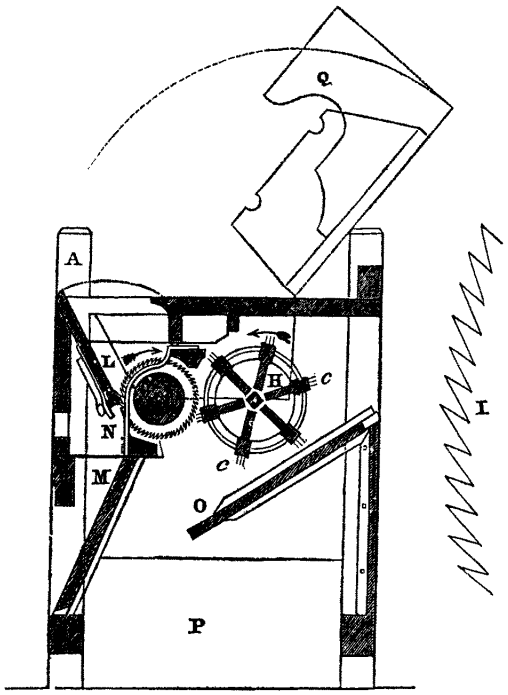
am told they make them, that will clean from thirty to forty pounds clear cotton in a day, and upon a very simple construction. It would be the interest of the planter to sell it in the seed for the following reasons: in the winter we can employ our servants in cutting lumber, ditching and clearing land. Secondly, they are as handy and dexterous at any kind of machinery in cleaning it as white people. With you, labour is cheap, people are numerous, and ginning of cotton can be done within doors in winter when no other work can be done. I am directed by Captain Kerby to apply to Mr. Wetherill or General Mifflin of Philadelphia, who are members of the society for encouraging manufactures. But as I am unacquainted with those gentlemen, I beg leave to do it through you and request you to lay the samples of the cotton I send you before them. I shall be glad to know what quantity would sell and what price it will fetch in the seed, and what price clean. If suitable encouragement is given, I have not the smallest doubt but that this state will be able to furnish all that will be necessary for the manufactures of the northern states. The lands in the southern parts of this state are admirably adapted to the raising of this commodity. The climate is so mild so far to the south, scarce any winter to be felt, and another grand advantage, *whites can be employed.* The labour is not severe attending it, not more than raising Indian corn, it is planted on high land, and thrives the best near the salt water. I shall be glad to receive any information or instructions from time to time, and will cheerfully communicate any further discoveries or experiments I make in the planting or raising a *raw material* of so much magnitude to the manufacturing interests of America." [From Richard Teake, Savannah, to Thomas Proctor, Philadelphia.]

WHITNEY'S COTTON GIN.—(*See cut in next page.*)

ELI WHITNEY was born at Westborough, Worcester county, Mass. Dec. 8th, 1763. The paternal ancestors of Mr. Whitney emigrated from England among the early settlers of Massachusetts.

Indications of Whitney's mechanical genius were developed at a very early age. Of his passion for such employments, his sister gives the following account. Our father had a workshop and sometimes made wheels of different kinds, and chairs. He had a variety of tools and a lathe for turning posts. This gave my brother an opportunity for learning the use of tools when very young. He lost no time, but as he could handle tools he was always making something in the shop, and seemed not to like working on the farm.

His father once enquired what Eli had been doing, he being about twelve years of age; the answer was, "*He has been making a fiddle.*" "I fear," said his father, "he will have to take his portion in fiddles."



After this he was employed to repair violins, which he always did to the satisfaction of his employers. He took occasion once to take his father's watch to pieces, and put it together without being detected. He made knives or any thing he attempted; also nails. He manifested a fondness for figures and an uncommon aptitude for arithmetical calculations. By his own personal exertion he prepared himself for the freshman class in Yale college, which he entered in May, 1789. He finished his education with little expense to his father. The propensity of Mr. Whitney to mechanical inventions and occupations was frequently apparent during his residence at college. On a particular occasion, one of the tutors happening to mention some interesting philosophical experiment, regretted he could not exhibit it to his pupils, because the apparatus was out of order and must be sent abroad to be repaired. Mr. Whitney proposed to undertake the task, and performed it greatly to the satisfaction of the faculty of the college.

Soon after Mr. Whitney took his degree, in the autumn of 1792, he entered into an engagement with a Mr. B. of Georgia, to reside in his family as a private teacher. On his way hither he was so fortunate as to have the company of Mrs. Green, the widow of General Green, who with her family was returning to Savannah, after spending the summer at the north. Mr. Whitney had scarcely set his foot in Georgia before he was met by a disappointment, which was an earnest of that long series of events which, with scarcely an exception, attended all his future negociations in the same state. On his arrival he was informed that Mr. B. had employed another teacher, leaving Whitney entirely without resources or friends, except those he had

made in the family of General Green. In these benevolent people, however, his case excited much interest, and Mrs. Green kindly said to him, "My young friend, make my house your home and pursue what studies you please." He accordingly commenced the study of the law under that hospitable roof.

Mr. Whitney made Mrs. Green a tambour frame; not long after this incident, a party of gentlemen came from Augusta and the upper country to visit the family of General Green, principally officers who had served under the general in the revolutionary war.

Among the number were Major Beman, Major Forsyth, and Major Pendleton. They conversed on the state of agriculture among them and expressed great regret that there was no means of cleaning the green seed cotton, or separating it from its seed, since all the lands which were unsuitable for cultivation of rice, would yield large crops of cotton. But until ingenuity could devise a machine which would greatly facilitate the process of cleaning, it was in vain to think of raising cotton for market. Separating one pound of the clean staple from the seed was a day's work for a woman.

While the company were engaged in this conversation, "Gentlemen," said Mrs. Green, "apply to my young friend, Mr. Whitney, he can make any thing." Upon which she conducted them into another room and showed them her tambour frame, and a number of toys which Mr. Whitney had made or repaired for the children. She then introduced them to Mr. Whitney himself, extolling his genius, and commended him to their notice and friendship. He modestly disclaimed all pretensions to mechanical genius, and that he had never seen either cotton or cotton seed in his life. A new turn was now given to Whitney's views. It being out of season for cotton in the seed, he went to Savannah, and searched among the warehouses and boats until he found a small parcel of it. This he carried home and communicated his intentions to Mr. Miller, who warmly encouraged him, and assigned him a room in the basement of the house, where he set himself to work, with such rude materials and instruments as a Georgia plantation at that time afforded. With these resources he made tools better suited to his purpose, and drew his own wire, (of which the teeth of the early gins were made) an article which was not then to be found in the market of Savannah. Mrs. Green and Mr. Miller were the only persons who knew in what way he was employing himself. The many hours he spent in his mysterious pursuits afforded matter of great curiosity and often raillery, to the younger members of the family.

Near the close of the winter, the machine was so nearly complete as to leave no doubt of its success. Mrs. Green was eager to communicate to her numerous friends the knowledge of this important invention, peculiarly important, because then the market was glutted with all those articles which were suited to the climate of Georgia, and nothing could be found to give occupation to the negroes, and support of the white inhabitants. This opened suddenly to the planters boundless resources of wealth, and rendered the occupations of the slaves less unhealthy and less laborious than they were before.

Mrs. Green invited to her house gentlemen from different parts of the state, and on the next day after they had assembled, she conducted them to

a temporary building, which had been erected for the machine, and they saw with astonishment and delight, that more cotton could be separated from the seed in one day by the labour of a single hand, than could be done in the former manner in the space of many months.

Mr. Whitney might now have indulged in bright reveries of fortune and fame, but his inventive genius was tempered with an unusual share of the calm considerate qualities of the financier. He felt reluctant even to apply for a patent, foreseeing many difficulties and expenses that must arise. Nor did he like to relinquish the profession of the law.

The individual who contributed much to incite him to persevere in the undertaking was Phineas Miller, Esq. Mr. Miller was a native of Connecticut and a graduate of Yale college. He married the widow of General Green. He had considerable funds at command, and proposed to Mr. Whitney to become his joint adventurer, and to be at the whole expense of maturing the machine until it should be patented.

If the machine should succeed in its operation, the parties agreed, under legal formalities, that the profits and advantages arising, as well as all privileges and emoluments to be derived from patenting, making, vending, and working the same, should be mutually and equally shared between them. This instrument bears date May 27, 1793, and immediately afterwards they commenced business under the firm of Miller & Whitney. An invention so important to the agricultural interests, (as it has proved to every department of human industry) could not long remain a secret. The knowledge of it soon spread through the state, and so great was the excitement on the subject that multitudes of persons came from all quarters of the state to see the machine; but it was not deemed safe to gratify their curiosity until the patent right had been obtained.

But so determined were some of the people to obtain this treasure that neither law nor justice could restrain them, they broke open the building by night and carried away the machine. In this way the public became possessed of the invention; and before Mr. Whitney could complete his model and secure his patent, a number of machines were in successful operation, constructed with some slight deviation from the original, with the hope of evading the penalty for violating the patent right. Mr. Whitney repaired to Connecticut, where as far as possible he was to perfect the machine, obtain a patent, and manufacture and ship for Georgia such a number of machines as would supply the demand.

On the 20th of June, 1793, Mr. Whitney presented his petition for a patent to Mr. Jefferson, then secretary of state; but the prevalence of the yellow fever in Philadelphia, which was then the seat of government, prevented his conducting the business relative to the patent until several months afterwards. Mr. Whitney made oath to the invention, before the notary public of the city of New Haven, on the 20th of October, 1793. The importunity of Mr. Miller's letters urging Mr. Whitney to repair to Georgia, evinces how eager the Georgia planters were to enter the new field of enterprise which the genius of Whitney had laid open to them. In 1794, they borrowed money at 5 per cent. premium, besides the lawful interest; but as they wanted more funds they could not obtain them short of 20 per cent. premium. Sickness and other casualties prevented the business from being profitable, besides the perplexities and anxieties which the inventor incurred.

In March, 1795, in the midst of perplexities and discouragements, with the fever and ague, Mr. Whitney went to New York on business, and was detained there three weeks by his sickness. As soon as he was able to leave the house, he embarked on board a packet for New Haven. On his arrival at this place, he was suffering under one of those chills which precede the fever. As was usual on the arrival of the packet, people came on board to welcome their friends and to exchange salutations, when Mr. Whitney was informed that on the preceding day *his shop with all his machines and papers had been consumed by fire!* Thus suddenly was he reduced to absolute bankruptcy, having debts to the amount of four thousand dollars without any means of making payment. Mr. Whitney, however, had not a spirit to despond under difficulties and disappointments, but was by them excited to still more vigorous efforts; Mr. Miller, also, on hearing of this catastrophe, manifested a kindred spirit. While struggling with these multiplied misfortunes, intelligence was received from England, which threatened to give a final blow to all their hopes. It was, that the English manufacturers condemned the cotton cleaned by their machines, on the ground that the staple was greatly injured. On the receipt of this intelligence, Mr. Miller writes as follows:—"This stroke of misfortune is much heavier than that of the fire, unless the impression is immediately removed. For, with that which now governs the public mind on this subject, our patent would be worth little or nothing. Every one is afraid of the cotton. Not a purchaser in Savannah will pay full price for it. Even the merchants with whom I have made a contract for purchasing, begin to part with their money reluctantly. The trespassers on our right begin to laugh at our suits, and several of the most active men are now putting up the *roller gin*, and what is to the last degree vexing, many prefer their cotton to ours."

In 1796, Miller and Whitney had thirty gins at eight different places in the state of Georgia, some of which were carried on by horses or oxen, and some by water. A number of these were standing still for the want of means of supplying them. The company had also invested about ten thousand dollars in real estate, which was suited only to the purposes of ginning cotton. All things now conspired to threaten them with deep insolvency. Mr. Miller writes: "A few moments are only allowed me to tell you that the industry of our opponents is daily increasing, and that prejudices appear to be rapidly extending themselves in London against our cotton. Hasten to London, if you return immediately; our fortune, our all, depends upon it. —The process of patent ginning is now quite at a stand. I hear nothing of it except the condolence of a few real friends, who express their regrets that so promising an invention should have entirely failed." Mr. Whitney was on the eve of departing for England, whither he was going with the view of learning the certainty of the prejudices which were so currently reported to be entertained in England against the cotton cleaned by the patent gin, and the rumour of which was so industriously circulated throughout the southern papers, and should he find those prejudices to exist, firmly believing, as the event has shown, that they were utterly unfounded, he hoped to be able to remove them, by challenging the most rigorous trials.

He had several times fixed on the day of his departure, and on one occasion had actually engaged his passage and taken leave of some of his friends.

But he was in each case thwarted by an unexpected disappointment in regard to the funds necessary to defray the expenses of the voyage.

However brighter prospects seemed now to be opening upon them, from the more favourable reports that were made respecting the quality of their cotton. Respectable manufacturers both at home and abroad gave favourable certificates, and retailing merchants sought for the cotton cleaned by Whitney's gin, because it was greatly preferred by their customers, to any other in the market. This favourable turn in public opinion would have restored prosperity to the company had not the encroachments on their patent right become so extensive as almost to annihilate its value.

Mr. Miller writes May 11, 1797. "The event of our first patent suit after all our exertions made in such a variety of ways has gone against us. The preposterous custom of trying civil causes of this intricacy and magnitude by a common jury, together with the imperfection of the patent law, frustrated all our views, and disappointed expectations which had become very sanguine. Thus after four years of assiduous labour, fatigue, and difficulty, we are again set afloat by a new and unexpected obstacle."

Great efforts were made to obtain trial in a second suit in May 1798, when a great number of witnesses were called, from various parts of the country, one hundred miles from Savannah, at the regular session, but no judge appeared. In consequence of the failure of the first suit, and such a procrastination of the second, the encroachments on the patent right had been prodigiously multiplied, so as almost entirely to destroy the business of the patentees.

In April 1799, Mr. Miller writes. "The prospect of making any thing by the gin in this state, is at an end. Surreptitious gins are erected in every part of the country, and the jurymen at Augusta have come to an understanding among themselves, that they will never give a cause in our favour let the merits of the case be as they may."

Russel Goodrich, Esq. traveled through Georgia, for the purpose of collecting what was due Miller and Whitney for patent rights, but in consequence of evasions under different dishonourable pretences, he was unable to obtain money enough from all these claims to pay his travelling expenses.

The legislature of South Carolina, offered Messrs. Miller and Whitney fifty thousand dollars, which was accepted.

In Dec. 1802, Mr. Whitney negotiated a sale of his patent right with the state of North Carolina. The legislature laid a tax to be continued five years, to be collected by the sheriffs in the same manner as the public taxes, and after deducting the expenses, the avails were faithfully paid over to the patentees. A similar negotiation was made with the state of Tennessee.

The importance of the machine began to be universally acknowledged in that state, and various public meetings of the citizens were held, in which were adopted resolutions strongly in favour of a public contract with Miller & Whitney. Of one of those meetings General Jackson was chairman. South Carolina annulled their contract under various pretences.

In consequence of extraordinary proceedings of the legislature of Georgia, Tennessee suspended the payment of their tax.

That Mr. Whitney felt very keenly in regard to the severities practised towards him, is evident from the remonstrance which he presented to the legislature.

The subscriber says "he respectfully solicits permission to represent to the legislature of South Carolina, that he conceives himself to have been treated with unreasonable severity, in the measures recently taken against him, by and under their immediate direction. He holds that to be seized and dragged to prison without being allowed to be heard in answer to the charge against, and indeed without the exhibition of any specific charge, is a direct violation of the common right of every citizen of a free government; that the power in this case is all on one side, that whatever may be the issue of the process now instituted against him, he must in any case be subjected to great expense and extreme hardships, and that he considers the tribunal before which he is holden to appear to be wholly incompetent to decide, definitely, existing disputes between the state and Miller & Whitney. The subscriber avers that he has manifested no other than a disposition to fulfil all the stipulations entered into with the state of South Carolina with punctuality and good faith. And he begs leave to observe further, that to have industriously, laboriously, and exclusively, devoted many years of the prime of his life to the improvement of a machine, from which the citizens of South Carolina have already realised immense profits, which is worth to them millions, and from which their posterity to the latest generation must continue to derive the most important benefits; and in return, to be treated as a felon, a swindler, and a villain, has stung him to the very soul. And when he considers that this cruel persecution is inflicted by the very persons who are enjoying these great benefits, and expressly for the purpose of preventing his ever deriving the least advantage from his own labour, the acuteness of his feelings is altogether inexpressible. This machine enables one man to perform the work of a thousand."

Mr. Whitney's application to congress to prolong the time of his patent was rejected.

In a correspondence with Robert Fulton, Mr. Whitney observes: "The difficulties with which I have to contend, have originated principally in the want of a disposition in mankind to do justice. It was not interference with any thing before known, and it can seldom happen that an invention or improvement is so strongly marked and can be so clearly and specifically identified, and I have always believed that I should have no difficulty in causing my right to be respected if it had been less valuable and been used only by a small portion of the community. But the use of this machine being immensely profitable to almost every planter in the cotton districts, all were interested in trespassing on the patent right, and each kept the other in countenance. Demagogues made themselves popular by misrepresentation and unfounded clamour both against the right and against the law made for its protection. Hence there arose associations and combinations to oppose both. At one time but few men in Georgia dared to come into court and testify to the most simple facts within their knowledge relative to the use of the new machine. In one instance, I had great difficulty in proving that the machine had been used in Georgia, although at the same moment, there were three separate sets of this machinery in motion within fifty yards of the building in which the court sat, and so near that the rattling of the wheel was distinctly heard on the steps of the court house."

The most remarkable trait in the character of Mr. Whitney, aside from his inventive powers, was his perseverance; and this is the more remarkable,

because it is so common to find men of great powers of much actual invention deficient in this quality. One who knew him from early life says, "I have reflected often and much upon Mr. Whitney's character, and it has been a delightful study to me. I wish I had time to bring fully to view that particular excellence of mind, perseverance—in which he excelled all men that I have ever heard of."

The growing of cotton in the southern states was an original idea in the mind of Tench Coxe, who always said that the manufacture of a redundant staple must be the foundation of commerce and manufactures. Thus, laying agriculture in its proper place, as the basis for manufactures and commerce to build on; and not allowing it to be dependent on contingencies.

Mr. Coxe was an harbinger of light on this subject: he urged the subject with a force and energy peculiar to himself; always stating, most explicitly, that America was destitute of a redundant staple. England had long nursed their growth of wool; and it was their staple, the importance of which their Chancellor was ever to remember by his seat on the *woolsack*. America has now produced an article which has superseded the wool staple of England. Great Britain buys our cotton, manufactures it, and spreads her fabrics to all parts of the world. America, herself, needs no importation of cotton: she manufactures her own redundant staple, which no contingencies can deprive her of. Before a field of cotton was planted, and while we had nothing to manufacture, but were obliged to import even the raw material for their incipient measures in experiments of manufacture, Tench Coxe, with the eye of a political economist, who understood the true means of the wealth of nations, knew that the growth of cotton would enrich the south; that it would give vigour and energy to the north; and that both east and west would be mutually interested in the unity of agriculture, commerce, and manufactures. These unite all the vast resources which are combined in the vast capabilities of various climes, and of the immense variety of the industry, skill, and enterprise of mankind. These so operate as to work into each other's hands, so that no department of labour shall be lost, and that all the skill and mechanism, all the improvement in machinery and science shall be brought into full operation.

The writings now extant of Tench Coxe, prove, emphatically, that these were his great and enlightened views as a statesman, who was advocating principles that were to be the foundation of new empires; and of ameliorating the condition of mankind. It is not saying too much when we claim for him the appellation of

the *Father of the growth of cotton in America.* It was his constant theme; there was an enthusiasm on this subject, that those inferior beings who were unacquainted with his sources of vision, were astonished at. His views reached into future prospects; he saw, in vision, from his enlarged principles and his correct calculations, what we now see in reality:—America increasing the number of her states; the federal government, loaded with surplus funds in the treasury; immense cities rising in every direction; peace and abundance enjoyed in the wide extended empire, and each department of enterprise, manifesting that each is beneficial to the other, and that the prosperity of agriculture adds to the increase of both manufactures and commerce. Legitimate objects of commerce are to transport the surplus produce of agriculture, and manufactured productions, to such parts of the world as present a market, and to bring back such articles as cannot be produced at home.

"Until the revolution in the cultivation of cotton, by which it was converted, through the strenuous excitements of the friend of manufactures, from a petty object in little fields and gardens, into an extensive cultivation among the planters and farmers, there was no redundant raw material for the manufacture of cloths and stuffs, for apparel and furniture, in the United States. There is at this time no other redundant raw material. The green seed cotton was the best adapted to the general quality and situation, and to the climate of the southern states. But its cultivation, though perfectly pleasant and easy, was very much restrained by the extraordinary difficulty of separating it from the seeds. This operation required so much manual industry as greatly to impede the manufacture; and, of course, for the time, to prevent an extensive cultivation. In the year 1793 the *invaluable saw gin* was invented by a citizen of the United States, Mr. Whitney, and was so improved and perfected as to render it easy to separate the seed from one hundred millions of pounds weight of cotton wool, by the employment of three or four hundred persons; although it is alleged that it would require three hundred thousand persons to effect the same by hand. Mr. Whitney states the difference between its operation in common hands, and the ordinary manual operation, at one thousand to one. By the employment of this machinery, every vicinity can easily and expeditiously prepare its cotton for the manufacturing cards, and that in the aggregate, to any extent that the world could require, were it to clothe itself entirely in cotton manufactures. Thus has there been added, by our own invention, to the machinery, to facilitate the manufacture of a staple production of our soil, a single improvement, moveable

by water, steam, cattle, or hand; which has let loose those immense powers of agriculture to produce cotton wool, that were before declined." The above remarks of Tench Coxe are only specimens of those enlightened and enlarged ideas which were original with him; and as he knew them to be based upon unchangeable maxims, he indulged the discussion of them with an ardour and impetuosity of feeling, chastened with profound reasoning, that silenced those whose severity of feeling prevented their sound conviction. He never rested till the work was completed, and he lived to see the American staple preferred in the cotton markets, before the growth of any other country in the world. It has been proved, indubitably, that the adaptation of climate and soil was as decided as he declared it to be, before a bale of cotton had been shipped from Charleston.*

Tench Coxe appears to have inherited the talents and enterprise and even the peculiar turn of mind of his paternal grandfather, the first proprietor of Carolina, who in 1698, wrote of the natural capabilities of the south :†—" Cochineal is a commodity of

* The increase of the new staple is insured by the triumph of science and truth; while the decay of the old is manifest, by the perversity of error and despotism. The former will be extended in its influence, while the latter will be confined within its contracted sphere.

If the "*wool-sack*" was a significant seat for the Chancellor of the British Peers, to remind him of what was the great staple of the empire, the "*cotton bag*," the staple of the new world, may well be held in equal remembrance by the legislators of the Union. Every member ought to wear it, as the girdle of his loins, emblematical of the bulwark of the agricultural, manufacturing, and commercial interests of the United Republics: every officer of the government should be clad in the productions of this superabundant article, from the crowns of their heads to the soles of their feet: and every citizen should be enrobed with it in life, and shrouded in it in death. It was protected, in its infancy, by the administration of Washington, and it has proved, in its *youth*, the defence of the "*beauty and booty*" of every section of the country.

† *The American branch of the family of* Coxe.—The first ancestor of the Coxe family connected with America was Dr. Daniel Coxe, who was physician to the queen of Charles II., King of England, and also to Queen Anne. He was the principal proprietor of the soil of West Jersey, and sole proprietor of the government, he having held the office of governor, to him and his for ever. At the request of Queen Anne he surrendered the govern ment to the crown retaining the other proprietory rights.† A member of the Coxe family was always appointed by the crown, while there was a resident member in the province, a member of the royal council of New Jersey until

† This document is extant in an old folio edition of Laws of New Jersey, which I saw some years since.

great value, very necessary as the world goes, and costs England great sums of money, which may all be saved, there being in the province sufficient to furnish both us and our neighbours.

"Silk is a commodity of great use in England for many manufactures, it being imported from France, Italy, Sicily, Turkey and the East Indies; and there is no foreign commodity which exhausts more of our treasure. This province abounds with forests of mulberry trees, both white and red; a considerable quantity of silk may be here produced. It hath been tried in South Carolina, by Sir Nathaniel Johnson and others, and might be turned to great account. I would advise an imitation of the Chinese, who sow the mulberry seeds as we do pot-herbs, and to mow those of one year's growth for the young silk worms, the leaves being short and tender, fit food for them when first hatched; and the second for them when in their infancy; when grown strong they may be supplied with leaves from the trees, which method secures them from disease, which they are liable to when fed, from the beginning, with great rank leaves.

"Hemp and flax are very common in this country; sufficient to supply the British market. Besides we have a silk grass, which makes very pretty stuffs, such as comes from the East Indies,

the revolution. (See Smith's History of New Jersey for an account of this gentleman, called the great proprietor, &c,: also of his son Colonel Daniel Coxe, the first ancestor who resided in America.)

Dr. Coxe was also sole proprietor of the extensive province of Carolana,* an account of which is extant, in an octavo volume, written by his son, Colonel Daniel Coxe, called the "History of Carolana;" a copy of which will be found in the library of congress, the Philadelphia library, and the Athenæum of Philadelphia.

Colonel Coxe intermarried with Sarah, the only child of John Eckley, a Judge of the Supreme Court of Pennsylvania, and left issue: among others, William Coxe, who married Mary, the daughter of Tench Francis, Attorney General of the province of Pennsylvania. Tench Coxe was the son of this William and Mary Coxe, and was born in Philadelphia, 22d May, 1755, and died 17th July, 1824.

The charter was, in the extent of territory and powers, the most extensive ever granted by the crown to a subject, &c.: the family was, therefore, obliged to release it to the crown in consideration of a *mandamus* of the king conferring 100,000 acres of land in New York. Dr. Coxe was also a large proprietor in Pennsylvania, and nearly all the American provinces.

To his eldest son, Colonel Daniel Coxe, he gave all his American possessions, and this gentleman was the first of the family who resided in America. He arrived in America in 1709. (See Smith's History of New Jersey.

* *Carolana.*—This was the original name, and ought to have been so spelled in the previous mention of the province.

which they call *herba* stuffs, whereof a garment was made for Queen Elizabeth, whose ingredient came from Sir Walter Raleigh's colony, by him called Virginia, now North Carolina, a part of this province, which, to encourage colonies and plantations, she was pleased to wear for divers weeks. Excellent timber, turpentine, and every thing suitable for building ships. Iron, potash, materials for dyeing, such as logwood, campeachy wood, and many others, fusticks, &c. A valuable shrub called quassia, drank as a tea. Saltpetre, copper in abundance, lead in great quantities, with various metals and minerals, including both gold and silver."*

DIFFERENT GROWTHS OF COTTON.—FROM BAINES.

Cotton is now so extensively manufactured into a great variety of different qualities of cloth, that a short account of the various descriptions imported into the British market, with a few remarks

* " The plant of which indico is made, is very frequent in most of the southern parts of this country, and may possibly produce better than that made in our islands of Jamaica, &c. This province being in the same latitude with Agra and Byana, territories in the great mogul's country, whose indico is accounted the best of its kind in the world, and is double the price of ours. It is easily made, and the Indians may be assisting to us herein, if we think fit to undertake it. Besides, if we believe that judicious natural historian Hernando, there is in Mexico, and consequently here (being much the same climate) a plant or little shrub, which produces an indico abundantly more noble, and the colour more lively, than that which is the common indico. This the Spaniards call Azul, as being like Ultramarine.

" Ambergris or grey amber, is often found upon this coast from the cape of Florida to Mexico, which is of great value. The best, (for there are divers sorts,) is of equal worth to its weight in gold. This is agreed upon by the learned, to be a bitumen or naptha, which comes from certain springs or fountains, that empty themselves into the sea, and is coagulated by the salt water, as succinum commonly called amber, from another sort of bitumen or naptha, and in storms cast upon the coast. The same ambergris is also found upon the east side of the cape or peninsula of Florida, the Bahama islands, in the East Indies, and Brazil, and sometimes great lumps, even upon the coast of Cornwall and Ireland. And among others, I have read of a piece weighing eighty pounds, cast upon the coast of Cornwall, in the reign of King Charles I., which was bigger, till diminished by the countryman who found it, by greasing his cart wheels and boots, but discovered accidentally by an intelligent gentleman, who, riding by one of his carts, and perceiving a very grateful smell, enquired of the man whence it proceeded; he told him he had found a nasty grease upon the shore, which he hoped would have saved him the expense of kitchen stuff and tar for carts, harness, and boots, but it was of so poisonous a smell, that they were not able to endure it. The gentleman desiring to see the remainder, found it what he expected, purchased it at a very easy rate, presented it unto the queen, and was requited in places or employments far beyond the value of it.—*Coxe's Carolana.*'

upon their qualities,—the estimation in which they are generally held by manufacturers,—the countries where they are cultivated, &c., may, perhaps, not be uninteresting to managers, carding and spinning masters, and to those interested in its manufacture.*

Cotton is generally distinguished by its colour, and the length, strength, and fineness of its fibres. There are many varieties of

* Mr. Woodbury's letter on the culture and manufacture of cotton, is a bright exposition of the present state of the business; it transcends all possible conceptions of those who first conceived the project of raising cotton in the United States. Tench Coxe was ardent and sanguinary in his hopes and prospects on this subject, but he lived to see his expectations more than realised; we have lived to see what appeared incredible twenty years ago. America, who imported all her cotton for manufacture in 1791, at the present time raises and exports more than all the world besides; and the manufacturing nations of Europe are absolutely dependent on America for this staple. Not only is the business capable of an immense increase, but of important improvements; a finer article can be produced, such as will demand in Great Britain one dollar per pound.

The nankeen cotton can be raised of a finer fibre than in China; and a fabric of the nankeen yarn, mixed with silk, can be manufactured superior to any thing of the kind that has ever yet appeared either in Asia or Europe. This new article is worthy of the nicest attention, and I must press the subject, both on the growers of cotton, and the manufacturer, to cherish its cultivation and its use; an article which will be purely American, and which cannot be superseded in Europe for want of the raw material; nor in China, because they are destitute of machinery.

The immense amount of capital invested in the growth and manufacture of cotton, and the number of people employed in the business, renders it a subject of great importance. It must proceed and it must increase, and measures must be adopted to regulate the system, consistent with freedom and good morals. We cannot neglect this with impunity; and the whole community are interested in the course to be adopted and pursued, in relation to this business. Industry and talent must be called into exercise to promote the best possible order in the establishments and plantations, such as shall be satisfactory to the parties concerned; for there must be no variance, no discord, in an operation in which all are interested, and in which the prosperity of the whole of America is deeply involved.

Mr. Woodbury's letter has made a great impression; sixteen thousand copies have been published by congress; and I presume few persons were aware of the rapid and unparalleled increase of the exportation of cotton in the short space of twenty years. The number of persons employed, both in the culture and manufacture of cotton, calls for the consideration of the wise and good, of the various communities concerned; and instead of recriminating each other, let both exert themselves to remove whatever positive evils exist.

The labour necessary for the culture of cotton, is attended with less danger of affecting the health of the labourers, than either the culture of rice or tobacco; the cotton plantations therefore produce an amelioration of the condition of those employed; it is better than sugar, or any other article raised in southern climates; and hopes may be raised, on those con-

cotton, their names being principally derived from the countries where they are cultivated. Also, under each general name, there are various denominations, distinguished by the particular province or district of the country where they are grown. In the following short account of the different descriptions, each kind is classed under the name of the country in which it is cultivated.

Smyrna Wool. The cotton wool known by the above name, was formerly imported from the Levant, in quantities proportioned to the then trifling demand. At one time, it was the only cotton wool to be met with, excepting a few bags occasionally imported from the West Indies. Although it has a soft silky appearance, yet it is neither well fitted to endure the necessary operations in being manufactured into yarn, nor does it, when finished, make an article either of strength, beauty or durability. Only a small quantity is now imported, and is used chiefly for making candle-wick, being inflammable in a higher degree than any other kind of cotton.

East India Cotton includes Surat, Bengal, Madras, Bourbon, &c. The latter takes its name from the Isle of Bourbon, in the Indian ocean, where it is cultivated. It is generally a very superior cotton, both for strength and fineness, although short in the staple. For a number of years it was the only cotton used for spinning yarns of the finest quality, until superseded by Sea Island cotton, which is now found even superior to it. The other kinds of East India cotton are of very low quality. They have a fine glossy and silky appearance, yet are extremely short in the staple, and used only for spinning the lowest numbers of yarn. The imports have been on the increase for a number of years back, but especially since the partial opening of the trade to India; and it is supposed that the quantity cultivated might be greatly increased, and the quality improved, were it not for those impolitic regulations established under the East India monopoly

siderations, that an increase of happiness will be the consequence of the introduction of the cotton seed.

It is vain to expect to eradicate all evils from human society; circumstances must be adapted, so to contend with the evil, that good may have the pre-eminence; and where truth, justice, benevolence, and mercy, are predominant, ignorance, wretchedness, and vice, will be treated in a manner the most conducive to the peace and support of society. There must be an agreement of feeling on these subjects, as there is necessarily an accordance of interest.

This sensitiveness of feeling between the south and the north is very much to be regretted, and ought, seriously, to be avoided; and we trust every thing will be done to allay all excitement of this kind, which, without precaution, is liable to produce the most dangerous consequences to this confederacy.

for securing the revenue, &c. Hitherto East India cottons have generally been bought at the lowest prices in the British market, a proof of the low estimation in which they are held by manufacturers. But a new kind of cotton has lately been imported from Madras, said to have been raised from the same seed as the Sea Island. It is a fine white soft wool, having a silky or glossy appearance, very clean, and equal, if not superior in quality, to the Pernambuco, but rather short in the staple. It is much inferior to the Sea Island, but brings a much higher price than the common Madras cotton.

West India Cotton takes its name from those numerous islands, where it is still cultivated to a considerable extent, although the quantity imported into Great Britain is not now one fourth of what it was about fifteen or twenty years ago. In 1813 and 1814 the imports amounted to 73,219, and 74,800 packages; but since that period they have been gradually decreasing. In 1830 and 1831, the imports amounted only to 11,721 and 11,304; yet notwithstanding the great falling off in the quantity imported, in price, it ranks with Upland and the common and middling qualities of New Orleans. This wool is various in its qualities, but in general, it is a strong coarse article, irregular in the staple, and well adapted for the manufacture of the stouter fabrics of cloth to which it is mostly applied, but it is totally unfit for finer goods. It is said that the finest quality of cotton ever brought to the English market, or probably ever grown, was raised in one of the West India Islands, viz. Tobago, upon the estate of Mr. Bobley, between the years 1789 and 1792. That gentleman carried the cultivation of this article to some extent; but the price of cotton falling very low, and the growing of sugar becoming more profitable, in consequence of the destruction of the sugar plantations in the French islands, he was induced to convert his cotton plantation into a sugar one; and the production of cotton of this description was never attempted by any other person, though it is believed that the price it would command would amply repay the expense of growing it. The growth of cotton deserves attention so as to raise it in its greatest perfection, for lace and cambrics of the finest texture.

South American Cotton includes that imported from Brazils and Guiana. Brazil cottons are distinguished by the names of Pernambuco, Maranhaın, Bahia, Para, &c., according to the districts where they are grown. That which is known by the name of Pernambuco, is of a fine rich cream colour, and of superior quality. It long had the reputation of being superior to any

imported, the Bourbon and Sea Island excepted. In quality, Pernambuco ranks with Egyptian; the latter is finer, but very irregular. Maranham, Bahia, and Para wools partake much of the same general description, but are inferior both in strength and cleanness to the Pernambuco. The imports of cotton wool from the Brazils have been remarkably steady for a long period. They seem, indeed, to have undergone little or no variation these twenty years past. In 1830 and 1831, the imports amounted to 191,468 and 168,288 packages, or 33,889,836 and 29,786,976lbs. The cotton imported from the coast of Guiana is distinguished by the the name of Demerara cotton, is a strong glossy wool, pretty long, though unequal in the fibre, and generally well cleaned and picked before it is packed. It makes a clean stout thread, and is frequently used for fine wefts, or warps of a moderate fineness; it is rather coarse, however, for the finest qualities of either. It is usually classed with the Berbice, but the latter is considered rather inferior. In price and quality they rank with Egyptian and Pernambuco wools. Essequibo is something similar to those mentioned, but inferior. Cayenne cotton is not much imported; it is like the Demerara, a clean wool, but very hard in the staple, which makes it difficult to card and spin.

Surinam resembles the Demerara and Berbice in appearance, but is inferior, both in strength and fineness, and similar to the Essequibo; both of them are considered to be pretty much on a level in quality with the West India wools. The imports, consumption, &c. of Demerara and Berbice, Surinam, and other cottons from Guiana, have been on the decrease for some years back. The imports in 1830 and 1831 amounted to 1263 and 811 packages or 395,319 and 253,843lbs.

The first cotton imported into the English market from Egypt was in the year 1823. Since that period it has been annually imported in considerable quantities, amounting, on an average, to about 6,593,073lbs. It is a very superior wool, of a yellowish colour, not so fine and silky as the Sea Island, but ranks next to it in price and quality. It is irregular in staple, and slovenly got up; but no description of cotton loses less after passing through the operation of carding, and it incorporates freely with cotton of a shorter staple, such as New Orleans, Maranham, Bahia, &c. The best qualities of this wool are generally used by manufacturers for yarn of superior quality.

Cotton from the United States. Previous to the year 1790, North America did not supply England with a single pound weight of cotton; it was only after the termination of the American war

that cotton began to be cultivated in Carolina and Georgia, and it has succeeded so well, that it now forms one of the staple productions of the United States. But that which was first imported into the English market was very imperfectly cleaned, and, in consequence, was for some time used only for spinning low numbers. It was soon perceived, however, that the cotton grown upon the coast, termed Sea Island cotton, had a finer and longer staple than that which was produced farther up the country, and known by the name of Upland cotton. But some years elapsed before it was ascertained to be of a quality in every respect superior to that which was brought from the Isle of Bourbon, the only cotton then used for the finest qualities of yarn, but which now is entirely superseded by the former.

American cotton is generally distinguished by the names of Sea Island, Upland, New Orleans, Alabama, Tennessee, &c. Sea Island cotton is the finest that is imported into this country, or, indeed, that is known, and takes its name from being grown upon small sandy islands contiguous to the shores of Georgia and Carolina, and on the low grounds bordering on the sea. The principal of these islands are situated between Charleston and Savannah. It is a fine silky cotton, having a yellowish tinge, both long and strong in the staple, and used only for spinning the finest qualities of yarn, or for a superior quality of power loom warps. But its qualities differ so much, that the finest specimens are often more than double the price of the inferior sorts. Its close vicinity to the sea exposes it to the inclemencies of the weather, by which it is often injured, consequently that which is thus damaged sells at a much lower price than the better kinds of it. Upland cotton is a different species from Sea Island, and is grown in Virginia, North and South Carolina, and Georgia; and for a considerable time the cultivation was confined to these states. As the planting extended to the south, the quality varied in some respects, and the cotton received the name of its place of growth; hence, New Orleans cotton, Alabama, &c. &c.

That which is known in the market by the name of New Orleans is a very superior cotton, clean, soft, and of a glossy and silky appearance, rather short in the staple, and incorporates freely with other cottons of a longer staple. It is grown upon the banks of the Mississippi, and imported in great quantities into the English market, where it ranks in price and quality about equal to the common qualities of Brazil cottons. Alabama, Upland, &c. rank next to New Orleans, and are soft, short, and weak in staple. The cultivation of cotton wool is carried to a

very great extent in the United States at present. The quantities imported into England is estimated at upwards of 230,000,000lbs. yearly, and apparently still increasing.

Various methods of cleaning cotton have been adopted at different periods. In the West Indies, and on the continent of America, what is called the roller-gin has been long used. It consists of a pair of fluted rollers, about five eighths of an inch in diameter, and nine or ten inches long; these are fitted up in a frame, and motion being communicated to them, the cotton is passed through between them, by which means it is separated from the seed, the diameter of the rollers being so small, that the gins, when whole, cannot be drawn in between them. This is but a slow method, and therefore expensive, consequently used only for the best qualities of cotton. Switching the cotton was tried, but disapproved of by manufacturers, as tending greatly to injure it.

The cotton, called Bowed Georgia, takes its name from a mode of cleaning cotton, long in use. This was performed by means of the bow-string, which, being raised by the hand and suddenly let go, struck upon the cotton with great force, and thereby served both to separate the gins and open the cotton, so as to render it more fit for the processes that follow. But this mode, whatever advantages it might possess in point of quality, has been abandoned for others better adapted for quantity; and what is called Bowed Georgia has, for a long time, in reality, been cleaned by a machine denominated a saw-gin. This machine consists of a cylinder about the size of a weaver's beam, and teeth cut out like a saw, at equal distances from each other, from which it derives its name. Instead of these saws, the machine originally had wires like card teeth, but these having been found to make what is called white naps upon the cotton, the former was substituted in their place. The saws pull the cotton through a grating which has its openings so narrow that the seeds cannot get through. The grating being a little inclined to the horizon, cotton is thrown upon it by the negro attending the machine, when the teeth of the saws take hold of it and pull it through the openings, whilst the gins, being pressed out, roll down the surface of the grating, and escape by an opening in the side of the machine. By the centrifugal force of the cylinder, the roller is thrown backwards, aided by another cylinder covered with brushes, for cleaning the teeth.

This machine, though not very injurious to the cotton of a short staple, yet is seldom used for the finest Sea Island, or any other that is very long in the fibres. It is worthy of remark, that when the Upland Georgia cotton was first brought to the English market,

it yielded a higher price by about two pence per pound when it was cleaned by the roller-gin; but contrary to all expectation, the saw-gin is found much better adapted for cleaning this species of cotton than the other, and what is done by it is preferred by those who understand spinning. The saws separate the gins more effectually than the rollers, and at the same time give it a kind of teaseling, which is found highly beneficial to it.

The cultivation of cotton is by no means a difficult operation.* It is planted very much as corn is planted, in March, and the early part of April, (depending of course upon the relative northern or southern situation of the land) and kept free from weeds through the summer, by constant ploughing and hoeing. In its early stage it resembles, when seen at a little distance, what are called *bunch beans*, growing in hills or rows. In the fall it is picked out of the opening pods by slaves, who go along with a basket and gather all that they can pick out. This is a tedious mode of getting the cotton from the husk or pod that contains it. When it is gathered into the cotton house, then comes the work of cleaning it of the seeds, by means of the gin. This is a simple operation. The cotton passes between a revolving cylinder (with teeth in

* *Extract from Moses Brown's letter to J. S. Dexter.*

PROVIDENCE, Nov. 15, 1791.

"When it is considered that cotton, the raw material, may be raised in the United States, it shows that legislative attention should be paid to this subject. The cotton raised at present, in the southern states, is as imperfect as our manufactured goods. This, I presume, is owing to the promiscuous gathering, and saving of the article, from the pods in which it grows, some of which, like fruit on a tree, are fair and full grown, while others are not. In the picking of these, and in taking the cotton out of the pods, care should be taken that it be kept separate, and the thin membrane, which lines the pod, and sometimes comes off with the cotton, should be separated, and the clean, full grown, preserved to work on the machines; the other will answer to work by hand. But as the cotton must be clean before it works well on the card, the present production, in the mixed manner in which it is brought to market, does not answer a good purpose. The unripe, short, and dirty part, being enveloped with that which would be good, if separated properly at first, so spoils the whole as to discourage the use of it in the machines, and obliges the manufacturer to have his supply from the West Indies, under the charge of the impost, rather than work our own production. A circumstance truly mortifying to those, who from motives of promoting the produce and manufactures of our own country, as well as from interest, have been at much expense and trouble to promote so desirable an object. I, therefore, beg leave to suggest the idea of some encouragement to the raising and saving of cotton, clean and fit for the manufacturers."

Moses Brown told me that, for the above reasons, Mr. Slater could not be induced to use the American cotton.

circular rims of iron,) and a grate; by which the seeds are separated from the fine fibres of the cotton. It is next pressed into bales by a machine somewhat like a cider-press, and is then ready for market. A few good hands will cultivate several acres. From one to two bales, sometimes three, is the produce of an acre of good land in this state. The price of cotton lands is various,—from $10 or $20 to $40 per acre; according to quality, situation, buildings, and machinery on the premises. The above prices refer to the state of Mississippi.

To Whitemarsh B. Seabrook, Esq., Corresponding secretary of the Agricultural Society of St. John's, Colleton.

SULLLIVAN'S ISLAND, Sept. 1st, 1826.

Dear Sir,—Your useful circular has been received. I answer with pleasure your queries. Permit me to assure you, if I had the good fortune to possess any information, not generally known, upon the culture of the cotton plant or its preparation for market, nothing could afford me more satisfaction than to disclose it for the benefit of others. A planter who would, from interested motives, conceal any discoveries which might improve the culture or the preparation for sale of any of our staple products, must certainly be deficient in that patriotism and liberal feeling which, at least, are supposed to govern every gentleman in this community.

Question 1. Is all your cotton equally fine? If not, what description of your soil yields the most silky?

Ans. I consider that the most sandy parts of my soil produce the finest cotton and the most silky.

Q. 2. What manure do you esteem the best to improve the fineness of the staple?

Ans. I have never used any but the soft salt mud; it is taken out of the creek during winter and spread in the old alleys with the back of the hoe, about two inches thick in the lowest spots; and in the most sandy not more than a quarter of an inch. The land is then listed over the mud before it becomes hard. I have never manured more than eighty-five acres in one winter.

Q. 3. Is your cotton which is so distinguished for one quality, remarkable also for the length and strength of its staple, or both?

Ans. As machinery is the only test for fine cottons, allow me to give you an extract of a letter, addressed to me from one of the most respectable spinners in Manchester. "Although your cotton is second to no brand in health and fineness, still it does not possess sufficiently the latter requisite to spin our finest numbers."

Q. 4. What has been your average crop for the last five years, and what quantity do you plant to the hand?

Ans. I have never made more than 150lbs. to the acre, and plant very short to the hand, in consequence of not having a sufficient quantity of land.

Q. 5. Are you very particular in the selection of your seed, and which kind do you prefer, the small or the large, the perfectly clean, or that which is a little woolly.

Ans. I select that which has a little wool at the end, but am not satisfied as to the advantage of it.

Q. 6. Have you ever tested the experiment on the difference of the product and quality of cotton, from seed taken from the bottom, middle or top of the stalk?

Ans. Never.

Q. 7. How do you preserve your seed? Is it in a confined situation, or in a well ventilated room?

Ans. It is kept in a loft over my gin house, without any aperture to admit air.

Q. 8. In gathering your crop, do you ever pick the wool from those pods that from their immaturity are but imperfectly open?

Ans. Never.

Q. 9. Do you dry your cotton in the sun or in the shade? If in the sun, how long?

Ans. I always dry in the sun, and suffered it, until the last year, to remain on the cotton scaffold the greater part of the day.

Q. 10. What is your mode of preparation, and what quantity do you clean to the hand per day?

Ans. I require the cotton to be picked carefully from the pods, without leaves or dirt of any kind, and am very particular in the assorting before it goes to the gins. I give 28lbs. as a task in moting.

Q. 11. Are you in the habit of using the whipper before or after the cotton is ginned, or in both instances?

Ans. I use the whipper *only* for the cotton which is picked after frost, and for the stained; the operation is performed before it goes to the gins.

Q. 12. What is the character of your soil? Is your land high or low, indented with creeks, and how far from the ocean?

Ans. I have both high and low land in the same fields; white sand in the highest, and grey soil in the lowest. There are no creeks running into the fields; the distance from the ocean varies from a quarter to a half mile.

Yours respectfully,

E. VANDERHORST.

ST. HELENA, December 26, 1826.

Sir,—It would afford me much satisfaction could my limited experience enable me to throw a ray of light on the subject embraced in your queries. The replies to them you will accept more as matters of opinion than conclusions founded on definite practice.

Q. 1. Is all your cotton equally fine, &c.

Ans. I think not, but I have never heard purchasers remark any difference when I have separated the high from the low land. I prefer the cotton on the most sandy high hills, it being more productive and silky.

Q. 2. What manure do you esteem the best?

Ans. I have generally used the marsh mud taken from the creeks; sometimes green marsh.

Q. 3. Is your cotton so distinguished for one quality, remarkable for others, &c.

Ans. My cotton derives its character from its silkiness, strength, and evenness of fibre.

Q. 4. What has been your average crop for the last five years? and what quantity do you plant to the hand?

Ans. Caterpillars and storms have destroyed some of my most promising crops; but I think about 450lbs. per hand are about the average. I generally plant three and a half acres to the hand.

Q. 5. What kind of seed do you prefer?

Ans. I have generally preserved the seed from my earliest picking; sometimes I have planted seed exchanged with my friends both north and south. I think the cotton produced from the seed with a green tuft, the finest and most silky, though not the most productive. The finest I have seen, was from seed covered entirely with a green woolly coat.

Q. 6. Have you ever tested the experiment on the difference of the product and quality from seed taken from the bottom, middle, or top of the stalk?

Ans. I have not.

Q. 7. How do you preserve your seed?

Ans. I am not particular, so that it is kept dry.

Q. 8. Do you in gathering your crop pick those pods which, from their immaturity, are perfectly open?

Ans. My orders are to pass over defective pods, to save the trouble of selecting them when assorting; but, from the difficulty of seeing these executed, I presume they are much neglected, especially after a frost. We generally dry our cotton on a scaffold, unless it has been wet. I handle it as little as possible after it comes from the gin. We use the whipper, before the cotton goes to the gin, but not after.

Q. 9. What is your soil and situation?

Ans. High and low, mostly high; a yellow mixed sand on the hills, and black or grey in the narrow valleys, which run N.E. and S.W. through the extent of the island. I am on a neck of land, two sides of which are bounded by creeks, and one side by the ocean. I have *once* used a *machine-gin* from St. Simon's Island, to the rollers of which, made of hickory, I gave as many as six hundred revolutions in a minute. I ginned about twenty bales of cotton with this gin, and heard no complaint about the staple being injured; but my negroes continually putting it out of order, and my impelling power proving defective, I laid it aside. I introduce this remark, hoping that the want of a gin, as well adapted to the Sea Island cotton, as Whitney's saw gin is to the upland, may stimulate some of our planters in their exertions to procure one. THOMAS ASTON COFFIN.

JOHN'S ISLAND, St. John's, Colleton, Oct. 4th, 1826.

If any thing I may communicate will add but one idea to the general stock of useful knowledge already possessed by the agricultural community, I shall be gratified in being instrumental in promoting that object.

Ist. The cotton raised by me is all fine, but not equally so. I apprehend some shade of difference in the cotton of every field will be a certain result where there is any diversity of soil; or, while any inequality of strength in the land exists. I have hitherto believed that high, light, rich soils produce the finest cotton; but I have not yet tested this opinion by repeated or satisfactory experiments to decide whether I am correct or not.

2d. In different parts of my fields, as most convenient, I have used fresh

mud, salt mud, salt marsh, rushes, leaves, and rotten wood, and composts of the four latter with cow dung; applied in proportion to the natural strength of the land, and to the fertilising qualities of the manure; from twenty-one to eighty-four single horse cart loads per acre, so as to give health and vigour to the plants, and equalise their growth as nearly as possible. I am best pleased with the salt mud, salt marsh, and the compost of salt marsh and rushes, combined with animal manure. They improve the length, strength, and silky appearance of the staple in a great degree, but I am not certain that they increase the fineness of the fibre. I have noticed that cotton which has not arrived at full maturity from being injured by rust or frost, will be finer but of more tender fibre than cotton produced in the same field, fully matured, particularly on strong land.

3d. The length and strength of the staple depend chiefly on the natural strength of the soil; and on the application of fertilising manures, were necessary, in order to equalise the strength of the land as much as possible; when this is accomplished, the cotton produced will be nearly all alike.

4th. My average crops for the last five years, have been 98 pounds per acre; and two and a half to three acres are usually planted to the hand.

5th. I have generally been particular in selecting from the earliest ripe cotton, produced on the best land, the seed which has a small tuft at the point, and that which is clean and black; but neither of these will always produce the same kinds of seed only; they must be annually cleared of their degenerated woolly associates, which sometimes produce fine long cotton; but generally, the staple is short or of an uneven length. I have found it a good rule in saving all kinds of seed, to select that portion which is most perfect and comes to maturity first. The size of cotton seed varies like all other seeds, according to the strength or poverty of the soil in which it is produced. Its colour is also changed from black to brown, by exposure to the sun or frost. Seed may be kept close in a room, unless it be damp.

8th. My instructions to the gatherers are, to gather from the field, at every picking, all the cotton, good or bad, which is blown open sufficiently to enable them to extract the wool with ease. The reasons for being so particular are these: if the bad cotton be left to be gathered at a future period, before the gatherers return through the field it will have become so much bleached by the weather, that it cannot then be readily distinguished from the good, either by them or by the hands who afterwards sort it for the gins; and, if ginned with the good, the extreme weakness of its fibre will depreciate the value of the general crop in proportion to the quantity of it which may be mixed with the good.

9th. My directions given, are, to dry the cotton in the sun, only so much as will be necessary to prevent the seed being crushed by the rollers. This must be varied according to the state of the weather, and the condition in which the cotton is gathered from the field. When the weather is dry, if the gatherers go out after the dew has evaporated, the cotton is exposed to the sun on the sheets as fast as gathered, then spread in the house until the next day; then on the scaffold for five or six hours; and again spread in the house a few hours, to let the heat fly off, before it is packed away; I have found it sufficiently dry for the gins. If packed away damp, it will generate heat in a short time, ruin the fibre, and unfit the seed for planting. I prefer drying in the shade altogether, when practicable. One thing we are

sure of, the less cotton is exposed to the air, and the closer it is packed, the better it is. We think that exposure to the air is prejudicial, by drying the natural moisture of the fibre. Cotton dried before the fire becomes brittle and tender, and we doubt whether if damped again, it ever regains its natural strength.

10th. The gatherers commence their labour after the exsiccation of the dew; at every emptying of their picking bags, the stained and rotten cotton is taken out, with any leaves that may have fallen in. If the cotton has been gathered with care from the field, one hundred weight to each labourer may be separated with ease for the gins. The cotton is then passed through a double drum whipper, and goes to the gins. Five to seven weight to each gin is ginned in the evenings, or twenty-five weight of clean cotton for a day's work. The ginners are directed not to screw more pressure on the rollers than is necessary, to prevent the seed being crushed, and the cotton should be as evenly spread to the rollers as possible, to prevent injury to the staple. The moters prepare twenty-five to thirty weight each, for the bag. One person searches for a bag of three hundred weight, if the cotton has been cleanly moted. The sorting of the seed cotton, moting of the ginned cotton, and searching for the packer, are all done on frames of wood, or on coarse wire sieves reversed. The sieves I have found very convenient.

11th. I have generally used the whipper for the seed cotton only; but latterly have used it for the ginned cotton also, I think with great advantage, before moting, and it does no injury to the fibre, if passed through but once. The less fatigue the fibres are exposed to, the better; switching, if done in moderation, and so as *not to string the cotton*, (which is to be apprehended in long fine staple) is a very harmless, and we think, effective operation. Ginning by means of rollers, if much pressure is applied, or if the cotton is not evenly spread, so as to distribute the pressure equally, is dangerous; since pressure completely destroys the fibre. A distinguished spinner says: "I send you a sample of cotton, which has undergone pressure between a pair of smooth iron rollers; the staple is perfectly destroyed." Iron rollers are now generally out of use in this part of the country; but too much pressure upon hard wood rollers will also do much injury.

12th. My soil is partly of a low heavy loam and sand, and partly high brown mould and sand, and clay indented with creeks, and situate on a large salt river, about six miles from the ocean.

KINSEY BURDEN.

In my experiments on the culture of this valuable staple, I have not been as particular as other gentlemen; relying too much on my soil and situation, and the advantage of manure. The cotton produced at my John's Island plantation is preferred to that of Edisto; and the cotton of the latter to that of Slarm's Island. My soil at John's Island is generally grey or dark; at Edisto, yellow: and at Slarm's Island, a tenacious loam. I am decidedly of opinion, that gray lands produce as fine cotton as any other soil: however, I believe it is the contiguity to the ocean that renders my cotton so fine at John's Island. Salt mud has the preference to all other manures.

My cotton at Edisto is longer and stronger than that raised on John's Island. At Edisto, I have averaged about 160lbs. per acre, and at John's island, about 120lbs. Three and a half acres to the hand. Change seed

every second year. The seed kept in a loft or room, in which there is a free circulation of air. I do not pick the wool from those pods, that were but imperfectly open. I dry cotton in the sun one day, or until the seed can be cracked. When my cotton is well gathered from the field, each labourer assorts from 150 to 200lbs. in the seed. After the cotton has passed through the whipper, I never use it afterwards. The quantity of ginned cotton daily moted to the hand is 40lbs. In ginning, from 25 to 30lbs. is the task. My land, at John's Island, lies immediately on the ocean, with a bold creek running in the rear. At Edisto, it is much indented with creeks.

WM. SEABROOK, sen.

Previously to breaking the land, with plough or hoe, about 120 cart loads of *salt mud*, to the acre, are placed in convenient heaps at equal distances; a labourer then chops and scatters it, at the rate of about 50 cart loads per acre. The ground is then listed with a plough, drawn by a yoke of oxen, which partially turns in the mud under the list and covers the cow-pen manure; it is then bedded, either with the plough or hoe, in the usual manner. If the plough is used both for listing and bedding, a portion of the mud will be placed under the list, and another portion above it; which is the best mode of disposing of the manure, to give support to a needy soil. I commence planting about the 25th of March. The seed, without selection or preparation, is planted in hills, about twelve inches apart, or in the drill, as inclination suggests. The foregoing remarks apply to a tract of poor, high, light land, in which I reside, on Edisto Island. Four acres to the hand. I consider salt mud, as manure, highly valuable; it has a powerful tendency to increase the production of the cotton plant,—to hasten its maturity, and to make the fibre stronger and finer; it also gives consistency and strength to light, weak soils. On my plantations, we cautiously prevent the exposure of the seed to moisture. Best dried in the sun, before it is stowed in the cotton house. I finish thinning by the 15th of June, if possible, and hoeing about the 15th of July; between these dates, one hauling, or two at farthest, are fully sufficient. Cotton plants are much injured by too much nursing with the hoe. To keep down the grass, and thin early, are of primary importance. The bed should be kept very firm, to prevent, as much as possible, heavy rains from penetrating it, and to assist it in retaining moisture during a drought. Hauling gives the plant fresh growth, as often as repeated; and therefore, when resorted to late in the season, proper for hoeing, it has a tendency to cause disease in the fruit, or to make drop at each repetition. The bed should be hoed by drawing the hoe, obliquely, from the alley to the top, and the grass carefully shook off by hand. My cotton is not all equally fine, neither can any cottons, correctly, be deemed so. It is now ascertained that the finer qualities of this valuable article are fast disappearing from us. A spinner, in Manchester, says:—"Some years ago we readily found, in the cottons of different planters, a sufficient number of bags to spin all the fine yarns that were required: at the present period, when the consumption of fine yarns is doubled, we do not find, among all the cottons we examine, one bag per annum." This deterioration of our cottons appears natural, when we reflect, that the same effect is produced in our gardens and orchards.

Some of the finest cotton grew in Persia; its seed bears a strong resem-

blance to the green seed which produces our upland cotton, it being covered with a green wool, similar to that. Some foreign, coarse woolly seed, have, after 3 or 4 years' cultivation in this country, become clean black seed, and produced cotton of fine fibre, partially retaining its original nankeen colour. A superior cotton to any produced on our shores, is much wanted by English fine spinners: in 1826, a broker, in Liverpool, says:—"We have never regretted the purchase of really fine cotton; and although competition renders it necessary for us to purchase our cotton as cheaply as possible, yet we shall always feel a pleasure in adequately remunerating the growers of a really superior article."

All dirt and extraneous matter should be separated from the cotton by fanning, both before and after ginning. My lands are surrounded by rivers and creeks, and are contiguous to the ocean. Of the soil planted in cotton, one portion is alluvial, and the other is light, high, and sandy. I use the *Virginia Cotton Planter.*

JOHN R. MATHEWES.

Answer to Question 1st.—There is a slight difference in its texture, the most fertile, sandy soil, producing the finest staple.

A. to Q. 2d.—The use of manures in Alabama, of any kind, are but seldom tried on lands cultivated in cotton. But I think half rotted cotton seed gives greater activity to the growth of vegetation, (for one or two years,) than any other manure that can generally be obtained; and, consequently, produces an article of some superiority in texture. The third question I do not consider as applicable to any other than Sea Island.

A. to Q. 4th.—The average crop, through the state, might be set down at about 800 lbs. of seed cotton per acre; but many make from 1500 to 1800 pounds. It is customary to plant from seven to twelve acres, in cotton, to the hand.

A. to Q. 5th.—We make no selection of the seed we grow, but are particular to change them from one section of country to another, every three or four years. The principal object of an Alabama planter, is to plant of that kind of seed of which he can gather the most in a day.

A. to Q. 6th.—I have not.

A. to Q. 7th.—The usual method of preserving seed is to have them thrown from before the gin into an adjacent room; secure from moisture, though regardless of a confined, or free circulating air.

A. to Q. 8th.—Never.

A. to Q. 9th.—The cotton gathered in the first half of the day, is usually dried, from that time till night, on a scaffold, in the sun; that in the latter seldom requires drying.

A. to Q. 10th.—We seldom or ever pick our cotton, but put it in the gin as it is taken from the field. Hands gather from one to three hundred pounds per day.

A. to Q. 11th.—In neither.

A. to Q. 12th.—The character of the soil in middle Alabama is various. There is the sandy soil, with oak and hickory growth; and the sandy soil, with nothing but pine. The prairies have a mixture of lime with their soil; some exceedingly stiff, and others more loose and sandy. Their growth is oak, hickory, ash, elm, blackjack, poplar, &c. &c.

What is known with us as the little green seed, furnishes the finest staple and is the most productive, but being more difficult to gather, was exchanged for the Mexican, it being found that the seed degenerates that is grown on the same land for a succession of four or five years, and that it becomes subject to the disease known as the rot in cotton; which often destroys from an eighth to a fourth of the crop. We now purchase our seed, every fourth year, from a section of country on the Red River, known as the Petit Gulf.

Z. WATKINS.

The following tables are prepared from a document of the Secretary of the Treasury, furnished by order of Congress:

Millions of Pounds of Cotton grown in various Parts.

YEARS.	The World.	United States.	Brazil.	West Indies.	Egypt.	Rest of Africa.	India.	Rest of Asia.	Mexico and S. Americ.	Other places.
1791	490	2	22	12	—	46	130	190	68	—
1801	520	48	36	10	—	45	160	160	56	15
1811	555	80	35	12	.085	44	170	146	57	11
1821	630	180	32	10	6	40	175	135	44	8
1831	820	385	38	9	18	36	180	115	35	4
1834	900	460	30	8	25½	34	185	110	35	4

THE FOLLOWING WERE THE RELATIVE PORTIONS GROWN IN OUR DIFFERENT STATES.

YEARS.	Virg.	N. Car.	S. Car.	Georgia	Florida.	Alab.	Tenn.	Missis.	Louisi.	Arkans.
1791	—	—	1½	0½	—	—	—	—	—	—
1801	5	4	20	20	—	—	1	—	—	—
1811	8	7	40	40	—	—	3	—	2	—
1821	12	10	50	50	—	20	20	10	10	—
1826	25	18	70	70	2	45	45	30	38	0¼
1833	13	10	73	73	15	50	65	70	55	0¼
1834	10	9½	65½	65½	20	45	85	85	62	0½

Statement of the number of pounds of Cotton exported from the U. States to other places than Great Britain and France, in the year ending September 30, 1821, *to* 1835, *inclusive.*

Years.	To Russia.	Holland and Belgium.	Spain.	Spanish W. I.	Trieste.	Hanse Towns.	Italy and Malta.	All other places.
1821	304,680	4,186,096	284,832	772,296	34,976	748,110	897,804	2,506,777
1822	713,789	1,970,258	-	445,964	210,138	2,955,581	1,956,253	450,762
1823	309,678	4,650,548	-	-	177,789	2,356,594	217,663	833,332
1824	501,645	432,976	-	3,853	-	292,852	-	227,529
1825	133,934	1,420,225	-	-	-	577,109	980	509,031
1826	15,262	4,592,439	-	-	33,311	2,012,679	-	1,820,116
1827	147,101	5,861,400	7,999	-	183,204	3,389,514	148,170	1,440,547
1828	649,791	3,780,988	-	-	980,354	3,386,108	407,068	1,072,448
1829	227,883	9,595,337	-	-	4,071,247	6,857,796	1,056,387	1,261,925
1830	111,376	8,561,193	32,210	-	2,814,477	4,123,047	235,565	638,877
1831	761,735	972,659	555,098	-	2,778,858	2,416,765	305,695	2,243,741
1832	838,951	3,920,016	2,283,875	-	1,654,775	4,075,122	580,974	2,250,190
1833	1,447,405	2,673,253	758,216	-	1,107,600	1,870,620	-	1,759,615
1834	1,260,494	6,096,462	892,967	-	3,805,312	6,612,895	190,842	1,153,382
1835	974,801	5,694,358	878,219	-	4,943,061	2,788,147	12,952	1,493,760

Amount of Cotton Manufactures, at different Periods.

	$ (1815)	$ (1828)	$ (1832)	$ (1835)
Yearly Value in England, . .	95,000,000	171,000,000	144,000,000	160,500,000
——————— France, ...		40,000,000	54,000,000	62,000,000
——————— United States,	24,000,000	. . . .	30,000,000	47,500,000
Capital employed in manufacturing by machinery in England, ...		309,000,000	160,000,000	185,000,000
Ditto, ditto, in France, ...			115,000,000	. . . .
Ditto, ditto, in the United States,	40,000,000	. . . .	45,000,000	80,000,000

CAPITAL. The capital employed in growing cotton, with the income it yields, is a question of much interest and importance. But very little can be found concerning it in books, and the information obtained on it from different correspondents in the United States is defective, and is founded on quite different data in different states and by different persons.

The elements of any computation must be, the average cost per acre of cotton lands, wild or cleared, and if the former, the expense of clearing them; the amount of labour necessary per acre to produce a given quantity of raw cotton; the cost of labour, whether in the form of wages or otherwise; the expense of tools, horses, &c., with salaries of overseers, taxes paid, &c. &c.

One mode of making the computation is as follows:—The average cost of cotton lands, when wild, in the old states, did not probably exceed often half a dollar per acre, including fees for patents, &c. In the new states it has generally ranged from $1 25 to $2 per acre, depending on its quality, location, and the price of cotton. The actual settlers, in purchasing of capitalists, have generally been compelled to give an advance from 50 to 100 per cent.: sometimes much more.

The expense of clearing wild land averages from ten to fifteen dollars per acre. Land in a condition to be cultivated, will, on an average, in the United States, yield from 250lbs. to 300lbs. of clean cotton. In the old states, 125lbs. clean, or 500lbs. in the seed, is an ordinary crop. (Cooper's Polit. Econ., p. 96.) Coxe, in 1810, estimated it at 138lbs. and others at 120lbs. (Rees's Cyclop. art. "United States.")

It is believed, that one field hand or labourer, with the aid hereafter named, can cultivate, on an average, eight acres. Some say five to seven, and others ten. He will at the same time assist in raising five to eight acres of corn.

It is usual to employ, in this business, slave labour, and the next element in the calculation must be the capital invested in slaves for this purpose, and the annual cost of their maintenance.

The price of field hands has nearly or quite doubled in ten years; and they now often cost eight hundred or one thousand dollars, when formerly four and five hundred dollars were the usual rate each.

The maintenance of them is another item very differently computed.—Sometimes it is done by the purchase of more land and cultivating it, putting stock on it, of cows, sheep, &c.; so as, with the aid of other slaves, kept partly for that purpose and partly for the culture of cotton, to raise corn, pork, &c., to feed, and other materials to clothe, the whole. In such case, the additional land put in cultivation, the additional slaves bought, and the stock on the plantation, &c., must be considered as so much more capital.

The additional slaves, in such case, being more youthful, or more aged ones, or infirm females, may be fairly computed at an equal number with the field hands, but costing only about one half the price. The additional land should be for cultivation, about twenty acres for each field hand. The capital, in oxen, horses, sheep, tools for husbandry, &c., about $30 to each slave on the plantation.

To these must be added the capital which may be deemed temporary, and not as a permanent investment, and hence is to be all yearly returned, such as expense for extra clothing not made on the plantation, for medicine, overseers, tools for labour, taxes, freight, &c., which may be forty-five dollars to each slave.

Differing from these last data, in some respects, in substance, and wholly unlike in form, is another mode of computing all the capital invested except that in the mere cotton lands. Instead of estimating the price of slaves, &c. it may be considered that slave labour could be hired, with food, clothing, medicine, &c., at a cost for each field hand from $100 to $120 per year. That from $30 to $40 each would defray the annual expense of overseers, tools, horses for each, and that the additional and equal number of slaves, not prime field hands, could be hired and supported for less than one half of annual cost of the others.

On these data the cotton crop, as estimated for 1835, at four hundred and eighty millions of pounds, would grow on 1,600,000 acres at 300 lbs. per acre, or 1,920,000 at 250lbs. each. Considering that some lands wear out quick and are changed, probably the whole quantity cultivated for cotton in the United States, at this time, should be estimated at two millions or more of acres.

From the above elements the whole capital invested in growing the cotton crop in the United States can be readily computed. On one hypothesis, converting the whole capital into that which is permanent, and partly invested in lands, slaves, and tools, as fixed capital, and partly invested in bank or other stocks, or in loans so as to yield an income, and not a capital sufficient to defray those kind of expenses which are usually deemed temporary, and are yearly remunerated, or require what is called a circulating or floating capital, and the whole will amount to more than $900,000,000. On another hypothesis, considering the capital, as it generally is, divided into fixed and circulating; the capital as fixed, which is invested in lands, slaves, stocks of horses, tools, &c., and only about $30,000,000 for other expenses, as circulating or temporary, and to be itself, and not its income or interest, used and repaid yearly, and the whole capital of both kinds will not quite equal $800,000,000.

This last amount accords nearly with a still different mode of testing the quantity of capital, by supposing that the whole crop of 480,000,000 lbs., at ten cents per pound, being $48,000,000, would yield six per cent. on all the money invested in any way in raising the crop. If the capital used was all permanently invested, it would, on this hypothesis, amount to near eight hundred millions of dollars; but as from twenty-five to thirty millions of dollars is temporarily invested, and must itself be repaid yearly, the whole may, in the usual mode of treating of capital employed in such business, be considered rather under than over $800,000,000.

That amount, however, has been assumed as about correct, in the table,

and is near enough for the estimate and comparisons at different periods in this country, and at the same period between this and other countries. In others, as in India, Brazil, and Egypt, the cost of labour is less, and perhaps the amount of labour performed by each hand is believed to be less, independent of the failure there to use much the improved cotton gin.

Here, at 250 lbs. per acre as an average crop, and eight acres an average cultivation by one hand, the product would be 2,000 lbs. per hand, or at ten cents per pound, would be the average of $200 per field hand. All the planter obtains over ten cents per pound would yield him a large rate of interest above six per cent. to pay for the greater risk and uncertainty of capital invested in this species of property. The whole crop of 1834 was probably worth $75,000,000 at the actual market prices, though at ten cents per pound only $48,000,000.

It is difficult to institute any just comparison between the profits of capital invested here in the growing of cotton, and in the manufacture of it; as in the latter so much more in proportion is invested in temporary or circulating capital to pay for wages and stock, and the whole of which is to be annually repaid. Neither have I leisure for the details.

Indeed it might have comported better with the technical language of political economy to have divided the whole expenditures in raising cotton into three heads, viz: labour, capital, and land; to yield in return, wages for the labour, profit or interest on the capital, and rent for the land. (See Senior's Outline of Political Economy, page 165, from the Encyclopædia Metropolitana.) It will be easy, for those who prefer it, to throw the calculation into that form; but the results then, would not be such as accord best with the views proposed in this part of the table; which are, to present to the community here, in plain terms, and in a form as intelligible as possible to people at large, the amount of capital actually employed at different periods in growing the cotton crop in the United States; whether invested in the original purchase of lands, the clearing, or the culture of them; in the purchase of slaves, or in procuring an income for the payment, or in the actual payment of wages of free labour to raise the crop; for buying seed, tools, food, raiment, horses, &c., and for payment of taxes, overseers, or any other expense, incidental or direct, connected with the production of the crop.

Two brief statements of a very general character are subjoined, in illustration of some of the above remarks.

1st. The capital invested in cotton lands under cultivation, at two million acres, and worth, cleared, on an average, $20 per acre, is -	$40,000,000
The capital in field hands, and in other lands, stock, labour, &c., to feed and clothe them, at $100 per year, on 340,000 in number, would require the interest or income of a capital, at six per cent. of - - - - - -	554,000,000
The maintenance of 340,000 more assistants, &c., at $30 each per year, would require the income of a capital at six per cent. of - - - - - - -	167,000,000
The capital to supply enough interest or income to pay for tools, horses for ploughing, taxes, medicines, overseers, &c., at $30, for the first 340,000, would be - -	167,000,000
Making in all a permanent capital, if so used, equal to	$918,000,000

2d. The capital in cotton lands, as stated above - -	$40,000,000
Capital in the purchase of 340,000 field hands, at $800 each, on an average, - - - - - - - -	272,000,000
Capital in the other 340,000 to aid, and to raise food, clothing, &c., at half price, - - - - - -	136,000,000
Capital in horses, cattle, sheep, utensils, &c., for plantation, about $30 to each person, to aid in making food and clothing, &c. - - - - - -	20,400,000
Capital in other lands to support stock, raise corn, &c., at 20 acres to each of the 680,000, worth $20 per acre, cleared,	272,000,000
Capital, temporary or floating, to buy clothing not made on plantation, pay taxes, overseers, freight, tools for cotton, &c., $45 to each - - - - - -	30,600,000
	$771,000,000

The increase of American cotton is such, as to create the utmost astonishment that our vast capacity to produce it had so long rested without notice. The export, by the last return, was about 24 millions. The late General Washington was a lover of agriculture, understood it well, and was not inattentive to fair profit in his patriotic pursuits and private business: yet he does not appear ever to have noticed our country's capacity to produce cotton. This is the more remarkable, because nearly all his landed property was in the *cotton district* of the United States. No circumstance can more strongly prove the universal inadvertency of America to her capacity to produce cotton.

One of the beneficial effects of our present active cultivation of cotton is, that, while it yields the greatest agricultural profit in proportion to the capital in land and stock, it has a sure tendency to diminish the quantities of rice, tobacco, indigo, grain, and cattle raised in the cotton district of America, and keeps up the price of those articles in a manner highly favourable to those who raise them. The moderate quantity of rice produced in 1801 and 1802 is a positive evidence of this profitable truth. The North American rice is of the *best class*. The body of our rice planters raise but three quarter crops or half crops, from their attention to cotton. Having so much less to sell, the market is not glutted. The price is consequently not low. It is favourable. The raisers of Indian corn in the southern states have also turned to cotton. Hence Indian corn and pork are every where better supported in price, to the general benefit of our farmers. Much corn will go from counties out of the cotton district to counties in the cotton district for sale and consumption. So of fish, and all eatables and drinkables.

From these circumstances it will appear, that we have an universal and deep interest to keep up the price of cotton. Home demand ought not to be neglected or overlooked. *The cotton manufacture* merits the earliest and best attention of the Union and of the states. Scotland cannot pursue that manufacture to as much advantage as the middle, northern and eastern states of America. The British duty of one penny sterling is nearly two cents per pound. The freight, insurance, storage, commissions, duty and

other charges might be wholly or partly saved. We might use our own indigo, woad, madder, barks, and other dye stuffs, or those which we import and re-ship to Scotland, and other parts of Europe. The Scotish manufacturers are fed with our flour and that which they import, all the charges on which are saved so far as our own manufacturers consume our provisions. It appears to be expedient to give this great case of the *cotton manufacture* a complete examination and to make a luminous exhibition of it before our country. For which purpose it is respectfully suggested to the legislature of the United States, and those of the several states, to give the subject in charge (by an early reference) to the proper department of their respective executive governments, with instructions to enquire into, examine, consider and make report concerning the rise, progress, and present state of the cultivation of cotton, the course of the importation and exportation thereof since the 3d of March 1789, the course of the trade in cotton goods, since that day, the present state of the household and regular manufactory of cotton goods in the United States, and the measures which have been adopted by the Union and by the states to encourage the same, to the end of considering what further encouragement can and ought to be given by the governments to the cultivation, export, trade, and manufacture of cotton within the United States.—T. Coxe.

Circumstances connected with the cotton trade, chronologically arranged.

B.C. The cotton manufactures of India were taken notice of by the Greeks when Alexander overran Greece.

A.D. 1101. The measure of the ell fixed by Henry I.

1280. The manufacture of cotton introduced into China from India.

1500. The first attempt made to introduce cotton goods into England.

1560. Giuccardini records the Low Countries to be the depot of India goods and of cotton from the Levant.

1565. The first act of parliament relating to cotton goods.

1600. The first charter granted to the English East India company.

1631. Printed calicoes imported into England.

1640. Fustians made at Bolton.

1670. The Dutch loom first used in England.

1673. Blore in his History of Liverpool, speaks of great cotton manufactories in the adjacent parts.

1676. Calico printing first introduced into London.

1700. The manufacturing of muslins first attempted in Paisley.

1721. The weaving of India calicoes prohibited.

1725. Linens, lawns, and cambrics, first manufactured at Glasgow. Mr. James Monteith was the first manufacturer who warped a muslin web in Scotland.

1730. Cotton spinning attempted unsuccessfully by Mr. Wyat at Litchfield, who spun the first thread of cotton yarn ever produced without the intervention of the fingers.

1735. The cotton plant first cultivated in Surinam.

1738. Mr. Lewis Paul took out a patent for an improved mode of carding. The fly-shuttle invented by Mr. John Kay of Bury.

1742. The first mill for spinning cotton erected at Birmingham. It was moved by asses; but the machinery was sold in 1743.

1750. The fly-shuttle in general use.

1756. Cotton velvets and quiltings first made.

1760. Mr. James Hargreaves applies the stock card to the carding of cotton with some improvements.

1762. Cylinder cards invented. First used by the father of the late Sir Robert Peel.

1763. Rouen was the principal market for the sale of cotton wool.

1767. The spinning jenny invented by Mr. James Hargreaves.

1769. Mr. Arkwright, afterwards Sir Richard Arkwright, obtained his first patent for spinning with rollers, and built his first mill at Nottingham.

1770. 5521 bags of cotton imported into Liverpool from the West Indies, 3 from New York, 4 from Virginia and Maryland, and 3 barrels from North Carolina.

1774. Power Looms invented by the Rev. Dr. Cartwright.

1779. Cayenne, Surinam, Essequibo, Demerara, and St. Domingo cotton most in esteem.

Mule jenny invented by Samuel Crompton.

1781. Brazil cotton first imported from Maranham, but very dirty.

1782. James Watt obtains his patent for the steam engine.

1783. Surat, and also Bourbon cotton, first imported or known about this time.

1784. Arkwright's first patent expired.

Cotton manufactured in Great Britain this year was 11,280,238lbs., and valued at £3,950,000.

Cotton imported in small quantities from the United States.

1785. Mr. M'Intosh and Mr. Dale commenced dyeing turkey red in Glasgow.

1786. Bourbon cotton sold from 7s. 6d. to 10s. per lb.

1793. Cotton, the growth of the United States, first imported in large quantities, by way of the West Indies.

1797. Scutching machine, said to be invented by Mr. Snodgrass, and Mr. Cooper, first used at Johnstone.

About this time the saw-gin was invented.

1798. The Fame arrived with the first cargo of cotton from the East Indies.

1800 or 1801. The entire stock of American cotton in Liverpool one bag.

1803. Radcliff's dressing and warping machine invented.

1813. Trade to British India thrown open under certain restrictions.

1818. 105 millions of yards of cotton cloth manufacted in Glasgow, value £5,000,000.

1823. Cotton first imported from Egypt direct to Liverpool.

1825. Steam engines estimated at 893 horses' power, spinning cotton in and around Glasgow, in a space not more than two miles from the cross.

1830. The Danforth throstle frame introduced into England.

1832. Robert Montgomery of Johnstone (Scotland) obtained a patent for the three kingdoms for an improvement of the throstle frame, which it is considered will supersede all the machines hitherto used for spinning low numbers, also for making copes. The first entire machine was accidentally

destroyed. The second is now in full operation in the mill of John Miller, Esq. and giving entire satisfaction.

The value of cotton goods manufactured in 1832 in Great Britain estimated at £40,000,000 yearly, £20,000,000 of which are exported.

1834. Nankeen cotton raised in Georgia, manufactured at Lonsdale R. I.

The nankeen cotton of China has attained considerable celebrity, and it has been much disputed whether the nankeens are made from a cotton of their peculiar colour, or are dyed to that colour. There is now no doubt that the cotton is naturally of the same yellow tinge which it preserves when spun and woven into cloth; and it is of very fine quality. The nankeen cloth requires no dye; that raised by Mr. Forsyth in Georgia, is of a beautiful texture, and the cloth made from it surpasses any imported. It seems to be a mistake, that the colour of the cotton depends on some peculiarity in the soil. This new article of American produce promises to add much to the value of the staple, and to the increase of the manufacture.

—

PAWTUCKET, R. I. Sept. 1835.

Mrs. Williams, now living in this place, wove the first piece of cotton stripes, from yarn spun by S. Slater.

—

PRICE OF COTTON TWIST YARN.—BY S. SLATER.

1794—No. 12, 88 cts.; 16, 104 cts.; 20, 121 cts.
1795,6,7,8,9—Prices the same as above.
1800—No. 12, 103 cts.; 16, 119 cts.; 20, 136 cts.
1801,2—Prices the same as 1800.
1803—No. 12, 94 cts.; 16, 110 cts.; 50, 126 cts.
1804—The same as 1803.
1805—No. 12, 99 cts.; 16, 115 cts.; 20, 131 cts.

—

Copy of an original invoice of cotton yarn, in the year 1784, *and published by permission, to show the price of yarn at that period.*

"MANCHESTER, January 22, 1784.

Mr. Peter Heatley,

Bought of Richard Arkwright.

40 pounds of twist, No. 30, at 6s. 5d. . . .	£12	16 9
20 „ „ „ 31, at 6s. 8d.	6	13 4
	£19	10 0

Forwarded this day per Grundy."

N.B.—In the year 1784, the quantity of cotton imported into Great Britain, was 11,281,138lbs., consisting of West India, Surinam, and Berbice, no other sort being then imported: and the price of cotton during that year, fluctuated from one shilling to two shillings and one penny per lb.

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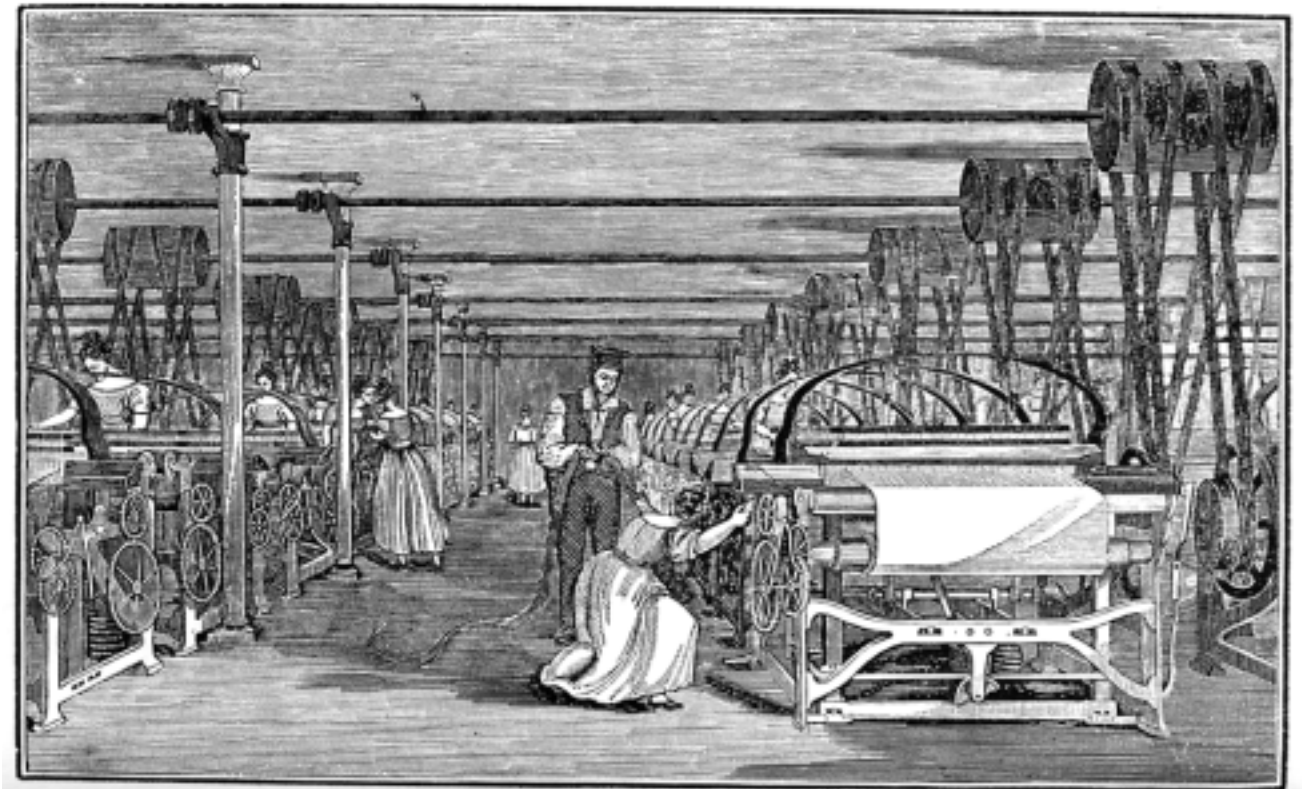
Paterson, New Jersey, is one of the creations of the genius of Alexander Hamilton, the true father of the system of domestic industry, now cherished as the American system. In the early part of the year 1791, on the recommendation, and by the active and influential exertions of this distinguished and patriotic statesman, a number of public spirited individuals of New York, New Jersey, and Pennsylvania, associated themselves for establishing

useful manufactures, by the subscription of $200,000. The number of shares originally subscribed was 5000, at $100 the share; but 2267 shares only were fully paid up. A great emporium of manufactures was the general object of the company; their immediate object was the manufacture of cotton cloths; and the attempt is highly characteristic of the enterprising spirit of our countrymen. At this period, the improvements of Arkwright in cotton machinery, though perfected, were not much used, even in England, and were absolutely unknown in all other countries. In America no cotton had been spun by machinery, except in Pawtucket, Rhode Island. The act of incorporation is said to have been drawn or revised by Hamilton. The society was organised at New Brunswick; on the last Monday of November 1791, by the choice of the first board of directors, composed of Messrs. Duer, Dewhurst, Walker, Low, Flint, Boudinot, Bayard, Neilson, Mercer, Lowring, Lewis, Furman, and M'Comb. William Duer was chosen the first governor of the company. These names are illustrious by the present flourishing condition of the society, the result of their labours. Mr. Hamilton, who was not a stock-holder of the company, and whose disinterested exertions in its behalf were prompted by higher motives than pecuniary gratification, had, previously to the act of incorporation, at the request of the company, engaged English and Scotish artisans, and manufacturers of cotton machinery and cotton goods, to establish their business here. In May 1792, the society selected, with admirable judgment, the Passaic, as the principal site of their proposed operations; giving to their town the name of Paterson, after the governor who had signed their charter. At this period there were not more than ten houses here. At a meeting of the directors, at the Godwin hotel, on the 4th July 1792, appropriations were made for building factories, machine shops, and shops for calico printing and weaving; and a race-way was directed to be made, for bringing the water from above the falls to the proposed mills. Unfortunately, the direction was given to Major l'Enfant, a French engineer, whose projects commonly perished in the waste of means provided for their attainment. He commenced the race-way and canal, designing to unite the Upper Passaic with the lower, at the head of tide, near the present village of Acquackanonck, by a plan better adapted to the resources of a great empire, than to those of a private company. In January 1793, Peter Colt of Hartford, then comptroller of the state of Connecticut, was appointed general superintendent of the affairs of the company, with full powers to manage the concerns of the society, as if they were his own individual property. Mr. Colt completed the race-way, conducting the water to the first factory erected by the society. The canal to tide water had been abandoned, before the departure of the engineer. The factory, 90 feet long by 40 wide, and 4 stories high, was finished in 1794, when cotton yarn was spun in the mill; but yarn had been spun in the preceding year, by machinery moved by oxen. In 1794, calico shawls and other cotton goods were printed; the bleached and unbleached muslins being purchased in New York. In the same year the society gave their attention to the culture of the silk worm, and directed the superintendant to plant the mulberry tree for this purpose. In April of this year, the society employed a teacher to instruct, gratuitously, on the sabbath, the children employed in the factory. This was probably the first Sunday school established in New Jersey. Notwithstanding their untoward com-

mencement, and the many discouragements attending their progress, the directors persevered in their enterprise, and during the years 1795 and 1796, much yarn of various sizes was spun, and several species of cotton fabrics were made. But, at length satisfied that it was hopeless to contend, successfully, longer with an adverse current, they resolved, July 1796, to abandon the manufacture, and discharged their workmen. This result was produced by a combination of causes. Nearly $50,000 had been lost, by the failure of the parties to certain bills of exchange purchased by the company, to buy in England plain cloths for printing: large sums had been wasted by the engineer; and the machinists and manufacturers imported, were presumptuous, and ignorant of many branches of the business they engaged to conduct; and more than all, a want of experience relative to the subject of the enterprise, and the country unprepared for manufactures. The cotton mill of the company was subsequently leased to individuals, who continued to spin candle-wick and coarse yarn until 1807, when it was accidentally burnt, and was never rebuilt. The admirable water-power of the company was not, however, wholly unemployed. In 1801, a mill seat was leased to Mr. Kinsey & Co.; in 1807 a second, and 1811, a third to other persons; and between 1812 and 1814, several others were sold or leased. In 1814, Mr. Colt purchased, at a depreciated price, a large proportion of the shares, and reanimated the association. From this date, the growth of Paterson has been steady, except during the three or four years that followed the peace of 1815. The advantages derivable from the great fall in the river, have been improved with much judgment. A dam of four and a half feet high, strongly framed and bolted to the rock in the bed of the river above the falls, turns the stream through a canal excavated in the trap rock of the bank, into a basin, whence, through strong guard-gates, it supplies in succession three canals on separate planes, each below the other; giving to the mills on each, a head and fall of about 22 feet. By means of the guard-gate, the volume of water is regulated at pleasure, and a uniform height preserved, avoiding the inconvenience of back-water; $40,000 have been expended to perfect this privilege.

The advantages to be derived from opening a navigable communication between the Delaware and the Chesapeake, early attracted the attention of enlightened men in the colony of Pennsylvania. The American Philosophical Society, in 1769 and 1774, appointed committees to explore and survey the country between the Delaware and the Chesapeake; and the legislature ordered similar explorations, some time later, of the country between the Delaware and the Susquehanna, with a view to opening an artificial communication between them. But the formidable nature of those objects, their novelty in this country, and, still more, the intervention of the revolutionary war, prevented the adoption, at that time, of any effectual measures for the attainment of those inestimable improvements. At length, in the year 1794, a number of public spirited citizens, and whom Robert Morris, the financier of the United States, to whom the nation was so largely indebted for procuring the ways and means, in "those times that tried men's souls," David Rittenhouse, Samuel Meredith, Walter Stewart, Benjamin R. Morgan, William Bingham, Rev. Dr. Smith, John Nicholson, Robert Hare, Levi Hollingsworth, Jonathan Bayard Smith, and James C. Fisher, entered with zeal on the business of internal improvement.



POWER LOOM WEAVING.

CHAPTER X.

ADVANCEMENT OF MACHINERY.

——————— "Art thrives most,
Where commerce has enriched the busy coast;
He catches all improvements in his flight,
Spreads foreign wonders in his country's sight,
Imports what others have invented well,
And stirs his own to match them, or excel."—*Cowper.*

POWER LOOM AND DRESSER.

In 1785 the Rev. Dr. Cartwright* of Hollander house, (brother of Major Cartwright, the well-known advocate of radical reform,) invented a power-loom, which may be regarded as the parent of that now in use. Dr. Cartwright was led by his invention to

* Edmund Cartwright was born in 1743, in Nottinghamshire, at Marnham, an estate which had long been in possession of his family. He was the youngest of three brothers, all of whom were remarkable men. His second brother, Captain William Cartwright, a man of great enterprise and energy of character, after a residence of sixteen years on the coast of Labrador, returned to England in 1792, and published his journal, which gave the first authentic account of the Esquimaux nations. His elder brother, Major John Cartwright, was forty years distinguished as an enthusiastic and persevering advocate for what is called parliamentary reform; and notwithstanding the many turbulent scenes in which he appeared in public, in domestic life he was exemplary as an amiable, affectionate and benevolent man; as a political leader he was truly consistent, and even his enemies have borne testimony to his being perfectly disinterested. Edmund, the younger brother, being destined for the church, was placed under Mr. Clarke of Wakefield, and the celebrated Dr. Langhorne. He afterwards studied at Oxford, where he was early distinguished for his literary attainments, and was elected fellow of Magdalen College. On entering the church, he retired to a small living in the gift of his family, where he discovered the application of yeast as a remedy in putrid fevers, and became known as a poet. His legendary tale of "Armine and Elvira," was greatly admired for its pathos and elegant simplicity. His "Prince of Peace," in a loftier style of composition, also excited much attention at its appearance. He married in 1772, and afterwards went to reside at Doncaster, but still assiduously continued his literary labours. Between 1774 and 1784, he was one of the principal contributors to the Monthly Review.

The origin of his invention of weaving by machinery instead of manual

undertake manufacturing with power-looms at Doncaster; but the concern was unsuccessful, and he at length abandoned it. Though he had a handsome paternal fortune, his affairs became

labour has been minutely detailed by himself, in a letter written to Mr. Dugald Bannatyne, of Glasgow.

"Happening to be at Matlock in the summer of 1784, I fell in company with some gentlemen of Manchester, when the conversation turned on Arkwright's spinning machinery. One of the company observed, that as soon as Arkwright's patent expired, so many mills would be erected, and so much cotton spun, that hands never could be found to weave it. To this observation I replied, that Arkwright must then set his wits to work to invent a weaving machine. This brought on a conversation on the subject, in which the Manchester gentlemen unanimously agreed, that the thing was impracticable; and in defence of their opinion they adduced arguments which I certainly was incompetent to answer, or even to comprehend, being totally ignorant of the subject, having never, at that time, seen a person weave. I controverted, however, the impracticability of the thing by remarking, that there had lately been exhibited in London an automaton figure which played at chess; 'now you will not assert, gentlemen,' said I, 'that it is more difficult to construct a machine that shall weave, than one which shall make all the variety of moves which are required in that complicated game?' Some little time afterwards a particular circumstance recalling this conversation to my mind, it struck me that, as in plain weaving, according to the conception I then had of the business, there could be only three movements, which were to follow each other in succession, there would be little difficulty in producing and repeating them. Full of these ideas, I immediately employed a carpenter and smith to carry them into effect. As soon as the machine was finished I got a weaver to put in the warp, which was of such materials as sail cloth is usually made of. To my great delight, a piece of cloth, such as it was, was the produce. As I had never before turned my thoughts to any thing mechanical, either in theory or practice, nor had ever seen a loom at work or knew any thing of its construction, it will readily be supposed that my first loom must have been a most rude piece of machinery. The warp was placed perpendicularly, the reed fell with a force of at least half a hundred weight, and the springs which threw the shuttle were strong enough to have thrown a Congreve rocket; in short it required the power of two strong men to work the machine at a slow rate only for a short time. Conceiving, in my great simplicity, that I had accomplished all that was required, I then secured what I thought a most valuable property, by a patent, in April 1785. This being done, I then condescended to see how other people wove, and you will guess my astonishment when I compared their easy modes of operation with mine. Availing myself, however, of what I then saw, I made a loom, in its general principles, nearly as they are now made, but it was not until the year 1787 that I completed my invention, when I took out my last weaving patent in August in that year."—This also included the art of weaving checks, which the most skilful mechanics, even after they had seen his first machines in operation, deemed to be impossible by any except manual

inextricably embarrassed; but he was more fortunate than most inventors, in obtaining from parliament, in 1809, a grant of £10,000, as a reward for his ingenuity.

The great obstacle to the success of the power-loom, was, that it was necessary to stop the machine frequently, in order to dress the warp as it unrolled from the beam, which operation required a man to be employed for each loom, so that there was no saving of expense. This difficulty was happily removed, by the invention of an extremely ingenious and effectual mode of dressing the warp before it was placed in the loom.

The dressing-machine was produced by Messrs. Radcliffe & Ross, cotton manufacturers, of Stockport; but they took out the patent in the name of Thomas Johnson, of Bredbury, a weaver in their employment, to whose inventive talent the machine was chiefly owing.

Wm. Radcliffe justly thought, that the most effectual way of securing for the country the manufacturing of the yarn, was to enable the English to excel as much in weaving as they did in spinning. He saw the obstacles to the accomplishment of this object, but being a man of determined purpose, he shut himself up in his mill, on the 2d of January, 1802, with a number of weavers, joiners, turners, and other workmen, and resolved to produce some great improvement. Two years were spent in experiments. He had for his assistant, Thomas Johnson, an ingenious but dissipated young man, to whom he explained what he wanted, and whose fertile invention suggested a great variety of expedients, so that he obtained the name of the "conjuror" among his fellow-workmen. Johnson's genius, and Radcliffe's judgement and perseverance, at length produced the dressing machine; an admirable invention, without which the power-loom could scarcely have been rendered efficient.

The process is thus briefly described:—"The yarn is first wound from the top upon bobbins, by a winding machine, in which operation it is passed through water, to increase its tenacity.

means. The weaving factory which was erected at Doncaster by some of Cartwright's friends, with his license, was unsuccessful; and another establishment containing five hundred looms, built at Manchester, was destroyed by an exasperated mob, in 1790. The invention, however, has surmounted all opposition, and at the time of the doctor's death it was stated that steam looms had increased so rapidly, that they were then performing the labour of two hundred thousand men! Cartwright's next invention was a method to comb wool with machinery, which excited, if possible, a still greater ferment among the working classes than even the power loom.

The bobbins are then put upon the warping-mill, and the web warped from them upon a beam belonging to the dressing-frame. From this beam, placed now in the dressing-frame, the warp is wound upon the weaving-beam, but in its progress to it passes through a hot dressing of starch. It is then compressed between two rollers, to free it from the moisture it had imbibed with the dressing, and drawn over a succession of tin cylinders heated by steam, to dry it; during the whole of this last part of its progress being lightly brushed as it moves along, and fanned by rapidly revolving fanners. The dressing here spoken of is merely a size or paste made of flour and water, now generally used cold; and the use of it is to make the minute fibres, which, as it were, feather the yarn, adhere closely to it, so that the warp may be smooth like catgut. The brushes essentially aid in smoothing the yarn, and distributing the size equally over it; and by means of the fan and the heated cylinders the warp is so soon dried, that it is wound upon the beam for the loom within a very short space after passing through the trough of paste. This machine, from the regularity and neatness of its motions, and its perfect efficacy, is equally beautiful and valuable."

Radcliffe and his partner took out four patents in the years 1803 and 1804; two of them for a useful improvement in the loom, the taking up of the cloth by the motion of the lathe; and the other two for the new mode of warping and dressing. Johnson, in whose name they were taken out, received by deed the sum of £50 in consideration of his services, and continued in their employment. Radcliffe's unremitting devotion to the perfecting of this apparatus, and other unfortunate circumstances, caused the affairs of his concern to fall into derangement, and he failed. He wrote a book entitled, "Origin of the New System of Manufacture, commonly called Power-Loom Weaving," showing the purposes for which this system was invented.

Baines says, "The dressing machine itself has now in some establishments been superseded, and the warp is dressed in a shorter and simpler way by an improved sizing apparatus. By the aid of Johnson and Radcliffe's invention, the power-loom became available. A patent for another power-looom was taken out in 1803, by Mr. H. Horrocks, cotton manufacturer, of Stockport, which he further improved, and took out subsequent patents in 1805 and 1813. Horrocks' loom is the one which has now come into general use; it is constructed entirely of iron, and is a neat, compact, and simple machine, moving with great rapidity, and occupying so little space that several hundreds may

be worked in a single room of a large factory. Horrocks, sharing the common destiny of inventors, failed and sunk into poverty. This retarded the adoption of the machine; but independently of this, the power-loom and dressing machine came very slowly into favour. In 1813, there were not more than one hundred of the latter machines in England and Scotland, and 2400 of the former in use.

The introduction of the power loom and dresser formed a new era in the cotton business in America.

Previous to 1815, the whole of the weaving was done by hand looms; in many of these looms great improvements had been made and a great quantity of cloth produced for home consumption. About the year 1814, Mr. Gilmore landed in Boston from England with patterns of the power loom and dresser; and John Slater, Esq. invited him to Smithfield, Rhode Island, and made known his wishes to construct these important inventions; but Mr. Slater could not prevail on the whole of his partners to engage him in the trial. He remained at Smithfield some time, employed as a machinist by that establishment. He introduced the hydrostatic press, and it proved of great advantage in pressing cloth, &c.

Judge Lyman of Providence had been endeavouring to obstruct the power-loom, but failed in the attempt; and on hearing of Mr. Gilmore, he with some other gentlemen entered into a contract with him to build the power-loom and dresser, from the patterns which he brought with him from England. He accomplished all that he promised, and received a compensation of $1500, to the great satisfaction of his patrons. They were soon introduced into Pawtucket, and David Wilkinson made them as an article of sale. Mr. Gilmore, however, neglected to turn his talents and opportunities to the advantage of his family, and died leaving them poor in this country.

S. Green informed me, that Gilmore was a man of great mechanical genius; he brought the first engineer's rule into Rhode Island, and Mr. Green obtained one from him, with a great deal of valuable information.

The hand-looms were immediately superseded, and now no one in the manufacturing districts thinks of using them any more than they do the one-thread wheel. Their introduction has enabled America to compete even with Great Britain in cotton cloths in South America and other foreign markets.

This is the crowning sequel in improvements in the cotton machinery, the addition of which has made a complete series, perhaps the most perfect which the world ever saw, whether with

regard to the mechanical excellence of its operations or its results. I have said that the power-loom formed a *new era*, and it is not easy to conceive how this series can be much improved, as it now exists in England and America.

BLEACHING AND CALENDERING.*

After the manufacture of the cloth is complete, there is the important process of bleaching to be undergone by all cotton goods; this is a very extensive branch of the business; it is necessary to remove the dirt and grease contracted in the manufacture, and the dressing applied to the warp, and also to destroy all the colour belonging to the raw material, so as to make the cloth perfectly white. The bleaching process, as performed in the middle of the last century, occupied from six to eight months. "It consisted in steeping the cloth in alkaline leys for several days, washing it clean, and spreading it on the grass for some weeks. The steeping in alkaline leys, called *bucking*, and the bleaching on the grass, called *crofting*, were repeated alternately for five or six times. The cloth was then steeped for some days in sour milk, washed clean, and crofted. These processes were repeated, diminishing every time the strength of the alkaline ley, till the linen had acquired the requisite whiteness." The art of bleaching was at that time so little understood in Great Britain, that nearly all the linens manufactured in Scotland were sent to Holland to bleach, and were kept there more than half a year, undergoing, in the bleach-fields around Haarlem, the tedious processes just described.

The grand improvement in bleaching was, in the application of *chlorine* to the art. This acid was discovered in 1774, by Scheele, the Swedish philosopher, who observed its property of destroying vegetable colours, from its having bleached the cork of his phial. This observation having been recorded, suggested to the active mind of the French chemist, Berthollet, the thought of applying the acid to the bleaching of cloths made of vegetable fibres; and, in 1785, having found by experiment that it answered the purpose, he made known this great discovery, which brings down the time

* Bleaching, calendering, &c. were introduced at a great expense, in Providence, by Dr. Bowen, where the water is well adapted, and there is now a bleaching and beetling establishment, called by his name. The bleaching business is now very extensive in the United States, and they are becoming more perfect in the process, as more attention is paid to every department in preparation for the calico printing.

Rhode Island appears to be in advance in the bleaching business, both for the quality and quantity of its work.

required for bleaching from months to days, or even to hours. James Watt learnt this at Paris, and introduced it into England in 1786.

Mr. Henry was one of the first persons to suggest the addition of lime, which takes away the noxious smell of the oxymuriatic acid without injuring its bleaching properties.

So great was the facility thus given to the process of bleaching, that it is recorded that a bleacher, in Lancashire, received fourteen hundred pieces of grey muslin on a Tuesday, which, on the Thursday immediately following, were returned, bleached, to the manufacturers, at the distance of sixteen miles; and they were packed up and sent off, that very day, to a foreign market. This is considered as not an extraordinary performance. Without this wonderful saving of time and capital, the quantity of cotton goods now manufactured could scarcely have been bleached.

Mr. Tennant, "after a great deal of most laborious and acute investigation," hit upon the method of making a saturated liquid of chloride of lime, which was found to answer perfectly all the purposes of the bleacher.

Mr. Tennant uses five and a half parts of black oxide of manganese, seven and a half parts of common salt, and twelve and a quarter parts of sulphuric acid, of the specific gravity of 1.843, diluted with an equal quantity of water to make the chlorine gas, with which he impregnates a layer of slacked lime, some inches thick, in a stone chamber. By recent improvements in the manufacture, he has doubled the value of the bleaching powder, whilst its price is reduced to one half; the present price is 3d. sterling per pound. By many bleachers this powder is used, mixed with a proper quantity of water; but the great bleachers use liquid chloride of lime, which they make in leaden stills; steam being used to expel the gas from the materials,—and the gas being received into a cream of lime, which becomes saturated with it.

The processes through which cottons pass in the hands of the bleacher, are as follows:—The cloth is first singed, by being drawn rapidly over a copper or iron cylinder heated to a red heat, which burns off the down and loose fibres on the surface, without injuring the fabric. It is next thrown, in loose folds, into a cistern of cold water, where it remains some time; and it is afterwards more effectually washed by being put into a large hollow wheel, called the dash-wheel, usually divided into four compartments; this is supplied with a jet of clear spring water, thrown in through a circular slit in the side, which revolves opposite the end of a flattened pipe, by which means the cloth is well washed, as it is

thrown backwards and forwards in the rapidly-revolving wheel. By this means a considerable portion of the weaver's dressing is removed. Next, the cloth is boiled with lime: the pieces of calico are placed in a kier, or boiler having a false bottom, perforated with holes, and with layers of cream of lime between the pieces; one pound of lime being used for every thirty-five pounds of the cloth. It is so contrived, that the boiling water is spouted on the goods, filters through them and the lime into that part of the boiler below the false bottom; is again forced up a pipe in the middle of the boiler, and falls again upon the goods: and this process is repeated for about eight hours. By this lime boiling the dressing, dirt, and grease, are removed from the cloth; and the lime itself is removed by a careful washing in the dash-wheel.

The cloth is now subjected to the action of the bleaching liquid; that is, chloride of lime dissolved in water.

A solution of one pound of bleaching powder with one gallon of water, has a specific gravity of 1.05; but water is added till the solution is reduced to the specific gravity of 1.02. The quantity of this liquor used for 700lbs. of cloth is 971 gallons; and 388lbs. of the solid bleaching powder is required for 700lbs. of cloth. The goods are left in the cold bleaching liquid about six hours, and when taken out they are considerably whitened. Having been washed, the cloth is next put into a very weak solution of sulphuric acid, containing eight gallons of the acid in 200 gallons of water. This is called the *souring* process, which lasts about four hours. By this the oxide of iron, which, in the course of the operations, has been deposited on the cloth, giving it a yellowish hue, and the lime which it had imbibed, are removed, and the cloth becomes much whiter. It is again washed in cold water, and then boiled for eight hours more in an alkaline ley. Sixty-four pounds of carbonate of soda are used to 2,100lbs. of unbleached cloth. After this the cloth is steeped a second time in the bleaching liquid, which is only two-thirds of the strength of the first, where it remains 5 or 6 hours; and a second time in the mixture of sulphuric acid and water, where it remains 4 hours. The last souring process completes the bleaching of the cloth, which comes out of the acid solution perfectly white. The cloth is then very carefully washed, to remove all trace of the sulphuric acid and water: it is freed from the greater part of the water by being squeezed between two rollers, and is then straightened and mangled in the damp state. To improve the appearance of the cloth, it is usually passed through starch made of wheaten flour, often mixed with porcelain clay and calcined sulphurate of lime; by which the cloth is made stiffer,

and appears to have great substance. (It would be creditable to the trade to lay this aside, as having the appearance of fraud.) The cloth is dried by being passed through a drying machine, consisting of several copper cylinders heated by steam: it is then again damped, in order to fit it to receive the gloss which is imparted in the process of calendering.*

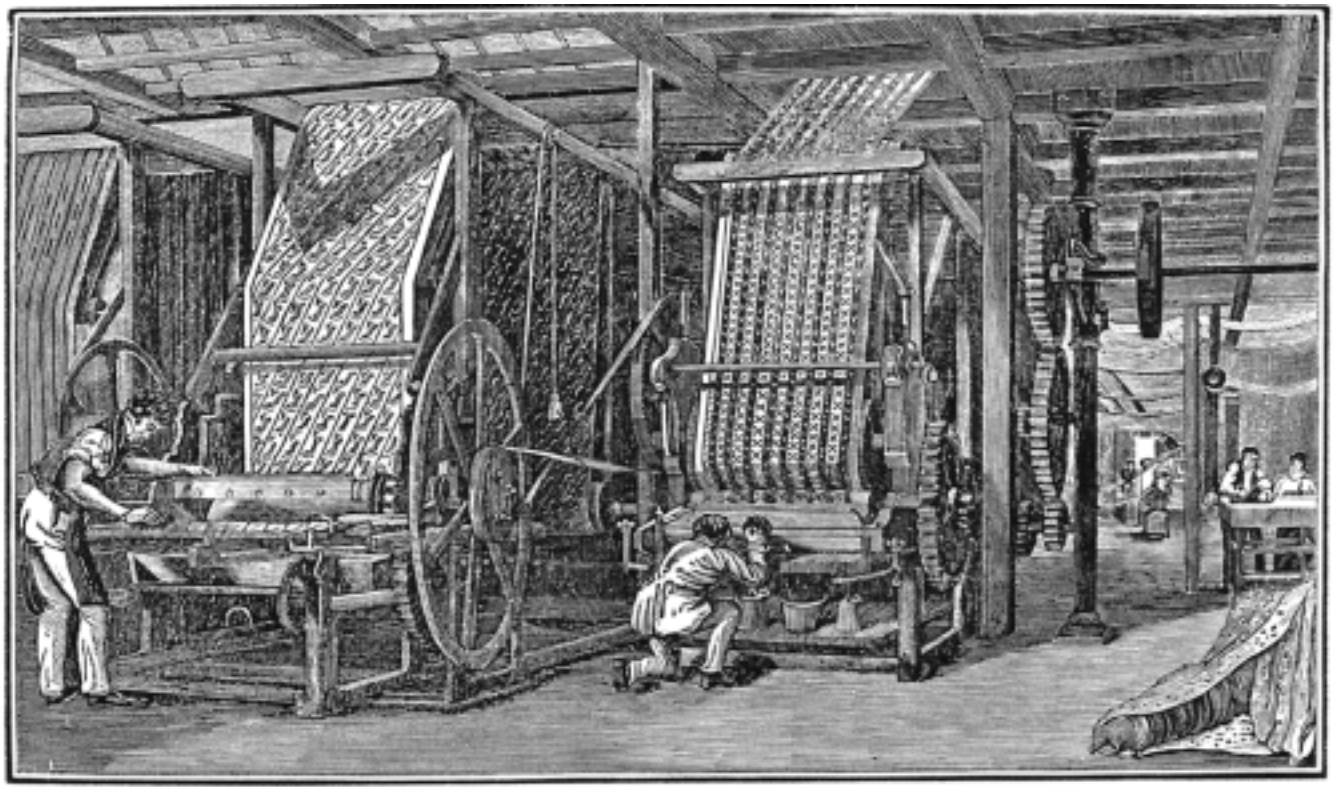
The calender consists of several wooden and iron rollers, placed above each other in a frame, and held together by levers and pulleys; the cloth, passing between these rollers, is strongly pressed; the surface becomes glossy, and sometimes it is made to assume a wiry appearance by two pieces being put through the calender together, in which case the threads of each are impressed on the face of the other. The goods are then folded up in pieces, stamped with marks varying according to the foreign or domestic markets for which they are intended, and pressed in a Bramah's press; after which they are packed up and sent to the merchant.

* *On Mangling Cloths.*—The business of smoothing cloths, as usually practised in the United States, is a very serious one in a warm day, and many females have laid the foundation for an attack of acute disease, and protracted ill-health, by fatigue and imprudent exposure to a current of air after being much heated by a hard day's duty. To remedy these evils, mangles have been invented. There are but few families in Europe without one of these useful machines, by which the numerous articles having plain, smooth surfaces, are smoothed with expedition, and acquire a gloss which cannot be given by flat irons. The following is the best.

Two horizontal cylindrical rollers form a bed for the roller on which the linen to be mangled is rolled. The axes of those rollers bear on brass, let into the wood frame, and have a wheel fixed to each, which works in a pinion on the axis of the fly-wheel: a moveable roller on which the linen to be mangled is rolled: a roller, the axis of which works in pieces of brass, which slide between iron, let into the inner side of the wood frame, to the bottom of which long pieces of iron are fixed, with hooks at their lower extremities, to which are attached the chains that support the scale or platform, where iron weights, or any other substance, are placed; to the top of the brass in which the roller works, the engine chains are fastened, which pass through apertures at each end of the top of the wood frame, and are there again fastened on the pulleys of the shaft with a screw: there is a lever fixed to the end of the shaft. To use the machine, press the lever, and fasten it with the hook, which raises the roller with the platform and weights attached to it: then take out the roller, and roll the linen and mangling cloth round it, and replace it on the two bottom rollers, unhook the lever, and the weights on the platform will press the roller on the other; give motion to the fly-wheel and also to all the rollers by turning the handle, which, in a short time, will make the linen beautifully smooth; press down the lever, fasten it with the hook, and take the roller out: a spare roller is supplied, so that if two people are employed, one may be filling it with linen, while the other is mangling.

Such are the processes by which the rough, gray and dirty fabric brought in by the weaver, is converted into the smooth and snowy cloth ready for the hands of the seamstress. The processes vary a little in duration and frequency, according to the quality of the cloth to be bleached. Every thing is done by machinery or by chemical agents, and the large bleach-works require steam engines of considerable power. Human hands only convey the cloth from process to process. There is much beauty in many of the operations; and great skill is needed in the mere disposition of the several cisterns and machines, so that the goods may pass through the processes with the smallest expenditure of time. Large capital has been expended on many of the bleach-works; an extraordinary perfection has been attained in the machinery, and in all the details of the arrangements strict method and order prevail; the managers are men of science, who are eager to adopt every chemical and mechanical improvement that may occur to themselves or others. The processes above described can be performed in two or three days, at the cost of a half-penny per yard, on cloth bleached and finished.

A perfect understanding of the bleaching business is essential to success; great quantities of cloth were destroyed in the process, by those who first made the experiment in this country; and even now great care is necessary to prevent the fabrics being injured; but this, like every other branch of manufacture, is becoming more perfect, and is carried on with greater economy and order, and all which is essential to success. My limits forbid enlargement, which, for the importance of the subject, deserves a volume of itself, to explain all its branches and modifications.



CALICO PRINTING.

CHAPTER XI.

CALICO PRINTING.

"Truth is not local; God alike pervades
And fills the world of traffic and the shades,
And may be feared amidst the busiest scenes
Or scorn'd where business never intervenes."

COWPER.

We come now to treat of the important art of calico printing, which constitutes a very large branch of the cotton manufacture, and by means of which the value of calicoes, muslins, and other cotton fabrics, are greatly enhanced. Cotton cloth, when used for the outer garments of the female sex, the drapery of beds and windows, the coverings of furniture, and similar purposes, is ornamented with colours and patterns. Unlike silk and woollen fabrics, cottons are very rarely dyed of a uniform colour throughout; a variety of colours is fixed upon a single piece, and they are printed on the white cotton or muslin in an endless variety of patterns, thus giving a light and elegant effect to the print. The art of the calico printer, therefore, not only comprehends that of the dyer, which requires all the aid of chemical science, but also that of the artist, for the designing of tasteful and elegant patterns; that of the engraver, for transferring those patterns to the metal used to impress them on the cloth; and that of the mechanician, for the various mechanical processes of engraving and printing. Taste, chemistry, and mechanics, have been called the three legs of calico printing.

Calico printing is believed not to have been practised in Europe till the seventeenth century. In what country the art was first introduced is doubtful.

Calico printing has been the subject of modern improvements, which may be compared in importance with those in cotton spinning and bleaching. First was the block printing. But the grand improvement in the art was the invention of cylinder printing, which bears nearly the same relation in point of despatch to block printing by hand, as throstle or mule spinning bears to spinning by the one thread wheel.

This great invention is said to have been made by a Scotsman of the name of Bell, and it was first successfully applied in Lan-

cashire, about the year 1785, at Morney, near Preston, by the house of Livesey, Hargreaves, Hull, & Co.; celebrated for the extent of their concerns, and the magnitude of their failure in 1788, which gave a severe shock to the industry of that part of the country. This new mode of printing may be thus described:—A polished copper cylinder, several feet in length, (according to the width of the piece to be printed,) and three or four inches in diameter, is engraved with a pattern round its whole circumference, and from end to end. It is then placed horizontally in a press, and, as it revolves, the lower part of the circumference passes through the colouring matter, which is again removed from the whole surface of the cylinder, except the engraved pattern, by an elastic steel blade, placed in contact with the cylinder, and reduced to so fine and straight an edge as to take off the colour without scratching the copper. This blade has received the name of the doctor, which may be a workman's abbreviation of the word abductor, applied to it from the purpose which it answers; or may have been given from a vulgar use of the word to doctor, meaning to set to rights. The colour being thus left only in the engraved pattern, the piece of calico or muslin is drawn lightly over the cylinder, which revolves in the same direction, and prints the cloth. After the piece is printed, it passes over several metallic boxes, six feet long, ten inches broad, and six inches deep, heated by steam, which dry it. A piece of cloth may be thus printed and dried in one or two minutes, which by the old method would require the application of the block 448 times. Nor is this all: two, three and even five cylinders may be used at the same time in one press; each cylinder having engraved upon it a different portion of the pattern, and being supplied with a different colour. The piece passes over them successively, and receives the entire pattern almost at the same moment. To produce the same effect by hand block printing would have required 896, 1344, 1792, or 2240 applications of the blocks, according as two, three, four or five cylinders may have been employed. The saving of labour, therefore, is immense: one of the cylinder printing machines, attended by a man and a boy, is actually capable of producing as much work as one hundred block printers and as many tear boys. But the course of improvement did not stop here. Another admirable invention, analogous to that just described, multiplied the advantage of cylinder printing.

The process of engraving itself, instead of being executed by the graver on the whole surface of the copper cylinder, is now performed by mechanical pressure, which transfers the pattern from a very small steel cylinder, only about three inches in length and one in

diameter, to the copper cylinder three or four feet in length. The principle of this invention is the same which Mr. Jacob Perkins applied to the multiplication of plates for the printing of bank-notes, and Mr. Perkins has the reputation of being its inventor. Mr. Joseph Lockett, engraver for calico-printers in Manchester, introduced this system about the year 1808: he may be considered as at least one of the inventors, and he certainly did more than any other person to perfect it. The method of transferring is as follows:—The pattern intended to be engraved is so arranged in the first place by a drawing made to agree with the circumference of the copper cylinder, as that it will join and appear continuous when repeated. This is then carefully followed by the engraver, and cut or sunk on a small steel cylinder, about three inches long and one thick, so softened or decarbonised as to admit of being easily cut. The steel is then tempered or hardened, and by means of pressure against another cylinder of softened steel, a fac-simile is made in relief, that is, raised upon the surface. The second cylinder is then hardened in the same way, and it becomes hard enough to impress the whole engraving, even to the most delicate lines on the copper cylinder, when pressed against it in a machine. The small cylinder originally engraved is called the die; the second cylinder, which is in relief, is called the mill. The latter is successively applied to the whole circumference of the copper cylinder, which is thus entirely covered with the pattern, as finely wrought as if it had been directly produced by the tool of the engraver. The surface of the die originally engraved is not more than about one-fiftieth part of the surface of the copper cylinder, and the engraving itself is therefore multiplied fifty-fold. By this means the most delicate designs, which would occupy an engraver as many months to effect by hand, can be completed in a few days; of course the cylinders are produced at a much less price, and they may be executed in a very superior manner. Should the copper cylinder be so far worn as to require the pattern to be re-engraved, it can be done by the same process with amazing rapidity, and at a very trifling cost, as the mill is already prepared.

Other modes of transferring are practised. In some cases the die is cut on a flat surface, and the pattern transferred in relief to a cylinder, which again transfers it to the copper cylinder at proper distances on the surface. In other cases the die is cylindrical, and the mill flat. When the design is very small, and requires to be repeated a great number of times on the copper cylinder, the pattern is engraved round the whole of the steel cylinder, so as to join or meet in the circumference, and at such

equal distances that every repetition, or part forming the pattern, will fall into its fac-simile, like the teeth in a wheel. The mill is then placed in contact with and compressed into the copper cylinder, by means of machinery which is made to traverse by a spiral movement, until the whole of the copper cylinder is covered. By this means the most minute patterns are produced, such as human ingenuity could not accomplish by any other method. Sometimes the copper cylinders are etched, instead of being engraved,—a plan invented by Mr. John Bradbury of Manchester, extensively practised by Messrs. Joseph Lockett, jr. & Co.; and which is likely to prove of very great benefit to the printing business. The polished cylinder, having been heated, is covered with a thin coat of varnish, such as is used by historical engravers. The pattern is then traced on the cylinder with a diamond pointed tracer, by means of a most complicated and ingenious system of machinery, the invention of Mr. Lockett, sen.; and the varnish having been thus removed from the figure, the cylinder is immersed in aquafortis, and the parts exposed become corroded or engraved. The value of this process depends entirely on the beauty and novelty of the pattern. The tracing machinery is capable, like the kaleidoscope, of producing an endless variety of patterns, yet without being, like that instrument, dependent on mere accident for its changes. It has been so far perfected, that it will follow to a considerable extent designs made by persons perfectly unacquainted with its construction; and patterns may be produced by it which cannot be copied, or in many instances even imitated, by other means.

So great is the reputation acquired by the engravers of Manchester, from their skill and the perfection of their machinery, that orders are sent there for engraved cylinders from all parts of Europe and America where cylinder printing is practised; even though the cost and risk of getting them to their destination should treble or quadruple their original price.

The beautiful and admirable inventions we have described, do not complete even the mechanical improvements in calico printing. It is still found necessary to execute parts of the patterns in fine goods with blocks, after the ground-work has been laid on by the cylinders; because different parts of the pattern, executed with different colours, cannot be made so exactly to fall into and fit with the other parts, by the cylinder as by the block. About the year 1802, an important improvement was made in the construction of blocks, for which the art is indebted to the workmen of London. Formerly all the blocks were cut in wood, like ordinary wood-cuts

used in the prints of books, but the work was necessarily coarser, to endure the wear and tear of so many impressions; each piece of cloth, as has been stated, requires the application of the block 448 times, and, of course, 100 pieces would require its application 44,800 times. If the design, therefore, was fine and elaborate, the block would soon wear away. The improvement effected removes this objection. The pattern, instead of being cut in relief on the wood, is (in many cases), raised on the surface of a plain block, by pieces of flat copper, or brass wire, of various thicknesses and forms, produced by drawing the wire through dies of various shapes. These pieces of wire are set into the wood, and all stand exactly the same height, namely, about the eighth of an inch. The thicker parts of the pattern have merely the outline formed of copper, and they are filled up with felt. Blocks on this improved construction are ten-fold more durable than the old wooden blocks, and when the metal is worn down nearly to the surface of the wood, the last impression is as good as the first. The successful application of engraved copper cylinders to printing, was followed by that of cylindrical blocks, or engraved wooden rollers. This mode of printing, which is practised extensively in some establishments, is called surface-printing. The union of the two systems in the same machine, that is, of a wooden cylinder in relief with an engraved copper cylinder, forms what has been denominated the union or mule machine, and was the invention of Mr. James Burton, about the year 1805, whilst he was engineer in the establishment of Messrs. Peel & Co., of Church.

Many minor improvements have been made in the mechanical department of calico printing, but those which have been described are by far the greatest, and for ingenuity and beauty, as well as for productive power, they well deserve to rank with the more celebrated inventions in cotton spinning. The chemical department of printing has been not less rich in discoveries than the mechanical.

The proper use of mordants lies at the foundation of the dyer's art. The nature of mordants is thus explained by Dr. Thomson: "The term mordant is applied by dyers to certain substances with which the cloth to be dyed must be impregnated, otherwise the colouring matters would not adhere to the cloth, but would be removed by washing. Thus the red colour given to cotton by madder would not be fixed, unless the cloth were previously steeped in a solution of a salt of alumina. It has been ascertained that the cloth has the property of decomposing the salt of alumina. The red colouring principle of the madder has an affinity for this

alumina, and combines with it. The consequence is that the alumina being firmly retained by the cloth, and the colouring matter by the alumina, the dye becomes fast, or cannot be removed by washing the cloth with water, even by the assistance of soap, though simple water is sufficient to remove the red colouring matter from the cloth, unless the alum mordant has been previously applied."

Mordant is also applied to certain substances, which have the property of altering the shade of colour, or of brightening the colour as it is called. The most valuable of all mordants is the acetated aluminous mordant, first employed by the calico-printers of England. By degrees they found out that sugar of lead and alum were the most important, and they discarded first one and then another of the ingredients they had been accustomed to mix with them, though without the aid of any chemical reasoning. The process of cylinder printing is very commonly employed to fix the mordant on the cloth, which is afterwards put into the dye-vat, when those parts only receive the colour which had previously been printed with the mordant, the other parts remaining white.

This was soon followed by the discovery of the process for producing what has been named resist-work, or neutral work. It consists in printing various mordants on those parts of the cloth intended to be coloured, and a paste or resist on such as are intended to remain white. It is the invention of a person named Grouse. It required the experience of a year or two to perfect this system, and make it practically useful. The house of Sir Robert Peel, of Bury, was the first to print by this plan so as to attract notice, 1802: it is now one of the most beautiful and perfect of the operations of modern calico printing. The discovery of new facts, as well as the ingenious application of known ones, has enabled Mr. Mercer of Oakenshaw to make the bronze style his own, and literally to transmute the ores of manganese into ores of gold. This ingenious individual possesses a store of knowledge and facts unknown to scientific chemists, and sought for in vain in their latest works. It is to be hoped he will have both leisure and inclination at some time to present a portion of his labours to the world.

The large print-works of Lancashire are among the most interesting manufactories that can be visited. Several of the proprietors or managers are scientific men; and being also persons of large capital, they have the most perfect machinery and the best furnished laboratories. All the processes through which the cloth has to pass, from the state in which it is left by the weaver, till it

is made up a finished print ready for the foreign or home market, are performed in these extensive establishments. The bleaching, the block-printing, the cylinder-printing, the dyeing, the engraving, both of blocks and cylinders, the designing of patterns, and the preparation of colours, all go on within the same enclosure. Some of the print works employ as many as a thousand workpeople. The order and cleanliness of the works, and the remarkable beauty of most of the operations, impress the visitor with admiration and surprise. A printing establishment, like a cotton mill, is a wonderful triumph of modern science; and when the mechanical and chemical improvements of both are viewed together, they form a splendid and matchless exhibition of science applied to the arts, and easily account for a rapidity of growth and a vastness of extension in the manufacture, which has no parallel in the records of industry.

Calico printing from cylinders.—Many of the patterns on printed calicoes are copies by printing from copper cylinders about four or five inches in diameter, on which the desired pattern has been previously engraved. One portion of the cylinders is exposed to the ink, whilst an elastic scraper of stuffed leather, by being pressed forcibly against another part, removes all superfluous ink from the surface previously to its reaching the cloth. A piece of calico twenty-eight yards in length rolls through this press, and is printed in four or five minutes.

Calico printing from blocks.—This is a mode of copying by surface-printing, from the ends of small pieces of copper wire, of various forms, fixed in a block of wood. They are all of one uniform height, about the eighth part of an inch above the surface of the wood, and are arranged by the maker into any required pattern. If the block be placed upon a piece of fine woollen cloth, on which ink of any colour has been uniformly spread, the projecting copper wires receive a portion which they give up when applied to the calico to be printed. By the former method of printing on calico, only one colour could be used; but by this plan, after the flower of a rose, for example, has been printed with one set of blocks, the leaves may be printed of another colour by a different set.

The following account was sent me from Messrs. Marshall's establishment:—

STOCKPORT, January 20th, 1836.

The Hudson print works (Stockport) were first established in 1826 on a very small scale; with one printing machine, small dye-house, and other

necessary operations, such as bleaching, &c.; sufficient for printing about 3000 yards per day. In the course of the year 1828 there were three printing machines imported from England, with all their necessary apparatus for dyeing the cloth by steam, and in the course of that and the two following years, the company were able to print 10,000 yards per day. About this time a new bleaching house was requisite, as the first one was on too small a scale. And a new dye-house and other offices were needful to keep pace with the three printing machines. In the year 1830 we had a severe fire, which burnt down the above bleaching house, and destroyed about 30,000 pieces of 30 yards each; say 900,000 yards.

At this time we erected other bleach works, competent to bleaching from four to five thousand pieces per week, and out of the ruins of the old bleaching house, which was a four story building, made a second dye-house. This being accomplished we were able to finish regularly 2,000 pieces per week, of permanent madder colours, besides our navy blues, &c. making in all 2500 pieces, or 75,000 yards per week. Our works now run much ahead of this. In our block shop we employ 42 block printers for printing by hand. We have now increased our establishment to five printing machines, two of which print four colours at once and three of three colours each, of the very best models in England and lately imported. With our present works, we can print an average of 120 pieces on each of these machines per day, making 600 pieces of 30 yards each, or 18,000 yards. Or in one year of fifty weeks, 5,400,000 yards, worth on an average 18 cents per yard, equal to $972,000 per year in sales. We employ about 250 hands, most of them men. We have every thing within ourselves for finishing the above in the first rate style of prints, either calicoes or furnitures. From the above you will find that we have increased since 1826 to this time from 300 to 1800 yards per day, and those of as good and fast colours as can be made in either England, France, &c.

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Hudson Calico Print Works, of Marshall, Carville, & Taylor.

The upper part of the calico works form a square; from the counting-house, which is at the entrance, we have a dry shed for drying the pieces, 200 feet long, running in a southerly direction; thence 200 feet east of the river, which supplies our water power. From the office in a northerly direction is a space of 200 feet, in the middle of which runs one string of buildings, occupied as follows, measuring in all 500 feet in height:—

1. Blue dye-house,	90	feet long	4	stories.
2. Machine, &c. and making-up rooms,	100	do.	4	do.
3. Steaming and boiler rooms,	60	do.	4	do.
4. Drying and colour rooms,	80	do.	3	do.
5. Boiling and evaporating room,	70	do.	1	do.
6. Block cutting, engraving, and drawing rooms,	100	do.	2	do.

In a northerly direction there are 200 feet, which is taken up by a two story piazza of 130 feet, as a conveyance from the above string of buildings to the madder dye-house, runs in an easterly direction, making the square above mentioned. In this square we have four other buildings: packing-room, where all our goods are packed for the market, our store-house for drugs, &c., one cloth room where all our printing cloths are stored secure from fire. The fourth is our block shop.

Besides the above buildings, we have our machine-shop, carpenter's shop, mills for grinding dye-woods, calenders for glazing, a dye-house, machine room, with three printing machine rooms, &c. for airing the goods after printing, with water power not half employed.

The madder dye house mentioned above, 286 feet long by 50 wide, I believe to be the largest ever built for that purpose; the main shaft frame water wheel being more than 300 feet long. Hoping this will give you some insight how far we have proceeded in calico printing, I remain your obedient servant, J. TAYLOR.

P.S. on the manufacturing of shirtings and fine printing cloths:—The two brothers, Joseph and Benjamin Marshall, having dissolved partnership, Benjamin Marshall at Troy has now all the factories; he makes the finest shirtings in the country, called the New York mills shirtings, besides the finest printing cloths.

Before the commencement of the printing bnsiness, the cotton manufacture was considered in a precarious condition; so that no one ventured on the finer fabrics, but since calico printing has been established, the cotton manufactures in the United States may safely be considered as built on a permanent basis.

The home consumption of cotton prints is immense; already the English and French articles have left our stores; and shortly printed goods will be sent to South America and other markets. Calico printing must therefore be considered of immense importance, both to the culture and manufacture of cotton. It is but yet in its infancy, and is capable of vast extension and improvement.

After the manufacture of the cloth is complete, there is the important process of bleaching to be undergone by all cotton goods, by which the rough, gray, and dirty fabric brought in by the weaver, is converted into the smooth and snowy cloth ready for the hands of the sempstress. The processes vary a little in duration and frequency, according to the quality of the cloth to be bleached. Every thing is done by machinery or by chemical agents, and the large bleach works require steam engines of considerable power. Human hands only convey the cloth from process to process. There is much beauty in many of the operations; and great skill is needed in the mere disposition of the several cisterns and machines, so that the goods may pass through the processes with the smallest expenditure of time. Large capital has been expended in many of the bleach works in England; and extraordinary perfection has been attained in the machinery and in all the details of the arrangements; strict method and order prevail; the managers are men of science, who are eager to adopt every che-

mical and mechanical improvement that may occur to themselves or to others. So greatly has bleaching been cheapened and quickened by the discoveries of modern science, that it costs only one cent a yard on the cloth bleached and finished.

Mr. Baines states that "the Americans print few of their cloths;" this must have referred to past information. From the calculations I have been able to make, one hundred and twenty millions of yards have been printed in the United States the last year, ending the 1st of April, 1836. And the prospect of an advance in quantity and quality is very great, as the demand justifies every exertion and improvement. In Rhode Island and Massachusetts the printing establishments are very considerable:—P. Allen, Providence; Sprague, Cranston; Crawford Allen, Pawtucket; one at Lowell, one at Taunton, and one at Fall River; one at Dover, New Hampshire; two at East Madden, Cheshire, two or three in New Jersey, and ten or twelve in Pennsylvania. The bleaching business is generally connected with the calico printing, as is the case of the Marshall's at Hudson.*

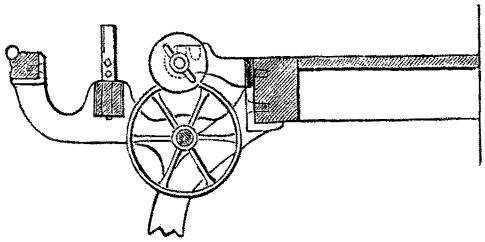
* The repeal of the print duty in England has proved highly beneficial, having given a stimulus both to production and to improvement. To the consumer it is a great relief, especially to the poor, as a woman can now buy a useful and respectable printed dress for *half-a-crown*, which before the repeal of the duty was a third more. A printed dress of good materials and a neat pattern, with fast colours, may now be bought for two shillings, or forty-seven cents. The large print works of Lancashire are among the most interesting manufactories that can be visited. Several of the proprietors or managers are scientific men; and being also persons of large capital, they have the most perfect machinery and the best furnished laboratories. All the proceeses through which the cloth has to pass, from the state in which it is left by the weaver, till it is made up a finished print ready for the foreign or home market, are performed in these extensive establishments. The bleaching, the block printing, the cylinder printing, the dyeing, the engraving both of blocks and cylinders, the designing of patterns, and the preparation of colours, all go on within the same enclosure. Some of the print-works employ as many as a thousand work-people. The order and cleanness of the works, and the remarkable beauty of most of the operations, impress the visiter with admiration and surprise.

Representation

of the different states of the Silk worm

CHAPTER XII.

SILK MACHINERY.



Bobbin Mechanism.

The plate annexed represents the series of changes from the formation of the egg to the death of the silk moth. We shall explain it with reference to the figures that are marked upon it.

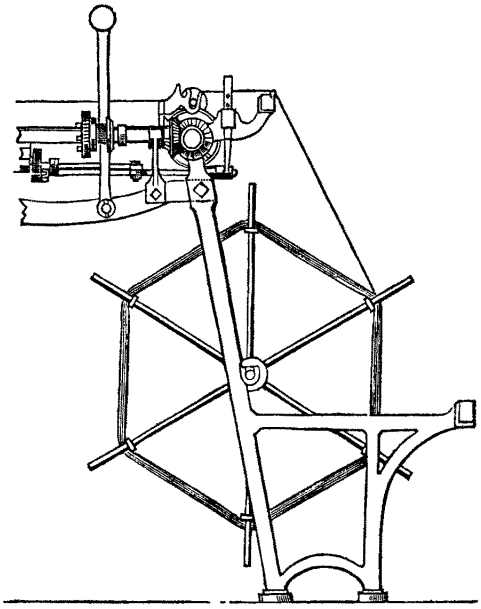
1. The egg, or the development and birth of the silk-caterpillar.
2. The silk-worms, during the first age, till their first moulting.
3. Rearing of the worms in the second age.
4. The worms in their third age.
5. Rearing of the silk-worm in the fourth age.
6. The rearing of the silk-worms during the fifth age, until the completion of the cocoon.
7. A species of silk-worm of a dark gray colour, with singular marks.
8. The cocoons.
9. Two open cocoons, or cocoons with their grubs. The upper one contains only the shell of a developed chrysalis, but in the lower is seen the immature chrysalis, with the skin of the late moth.
10. A cocoon, from which the butterfly is near emerging.
11. A cocoon from which the butterfly has already escaped.
12. Two butterflies in the act of coupling.
13. The female moth laying eggs.
14. Raw silk, of a yellow or white colour.
15. Here is represented the excremental substance of the silk-worm, in its first and last age.

The silk-worm is a robust little animal, and its organisation is

simple; but the rearing of it is often so defective, that, notwithstanding its sound constitution, it frequently perishes from the ill management it experiences in its rearing.

It must not be concealed, that some antagonists of this industry have maintained that it is injurious to the human constitution. But this is a mere prejudice, or a vain pretence. No human being has yet suffered, bodily, from this cause.

Silk Engine or Swift

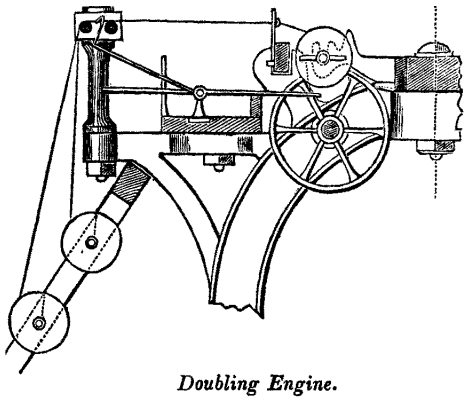


The machinery of the silk filature, from Dr. Ure.—These filatures are very simple; but the throwing-mills, for doubling and twisting silk, are most elaborate constructions. Ever since they were remodeled by Fairbairn, and upon the cotton-throstle plan, they are incomparably superior in convenience, precision and speed of performance, to what they formerly were in England, and still are in other parts of Europe. When these mechanicians took the silk-mill in hand, the spindles moved at the rate of only 1,200 revolutions per minute: they forthwith raised it to 3,000,—a velocity since increased to 4,500 by Ritson, a cotton mill mechanic, in whose favour they resigned this branch of engineering. The representations inserted are parts of a complete series of drawings made, under my inspection, from the latest and most improved silk-throwing machinery erected by him. The first operation

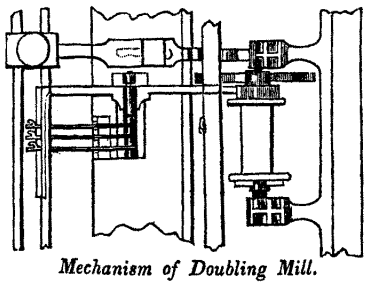
which raw silk undergoes in the factory, is its transfer, from skeins upon bobbins, in diagonal lines; so that the ends of the threads may be readily found, in case of breakage. The bobbins are wooden cylinders of such thickness as not to injure the filaments by sudden flexure, which smaller cylinders would do, and to be able to receive a considerable length of thread without materially increasing their diameters; and, of course, their surface velocity in revolving.

The winding machine, called the engine, consists of a long wooden table, for laying out the skeins upon. These are called *swifts*, because, though they turn slowly round with the revolving bobbins, yet they do their work quickly, compared with hand-winding machines.

Doubling Engine.—In the doubling of silk, where two or three threads are wound, parallel together, upon one bobbin, an ingenious contrivance is employed to stop the winding whenever one of the threads happens to break.

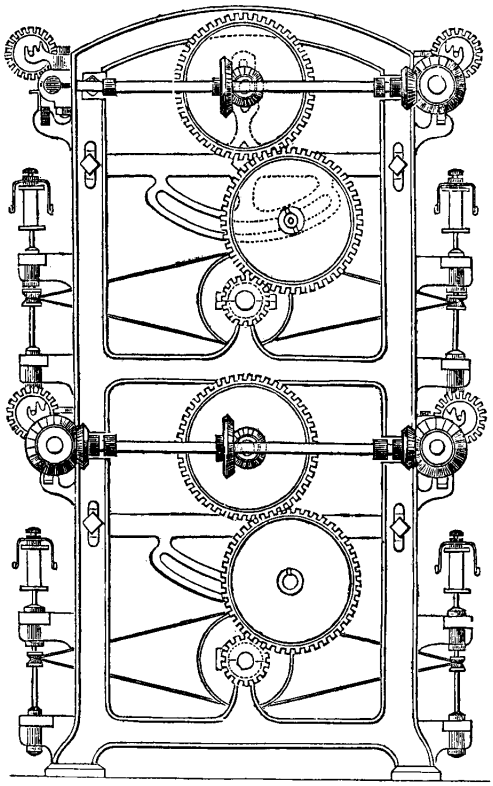


Doubling Engine.



Mechanism of Doubling Mill.

The machine for twisting the single threads of silk, either before the doubling or after the doubling, is called the *spinning-mill*, sometimes also the throwing-mill; though the latter term often



End view of Fairbairn's and Lillie's improved Silk Spinning Mill.

includes all the departments of a silk-mill. The section above, of this apparatus, shows four equal working lines, namely, two on each side of the frame, one tier being over the other. In some spinning mills there are three tiers, but the uppermost is a little troublesome to manage, as it requires the attendant to mount a stool or steps.

Silk undergoes certain preparations. The hanks of the raw silk are soaked in tepid soap-water in a tub; but the bobbins of the spun silk are steamed by inclosing a basket full of them within a wooden steam case, for about ten minutes. The bobbins are then removed into a cistern of warm water, from which they are taken to the doubling frame. It is probable that the power-loom will be applied to the weaving of fancy, as well as plain goods; which will give a great impulsion to the silk trade of England. Sharp & Roberts will readily furnish the requisite machinery for producing any wished-for design, however complicated. What is to prevent its introduction into America? In silk establishments, the

Silk Reel.

PLATE I.

Fig. 1

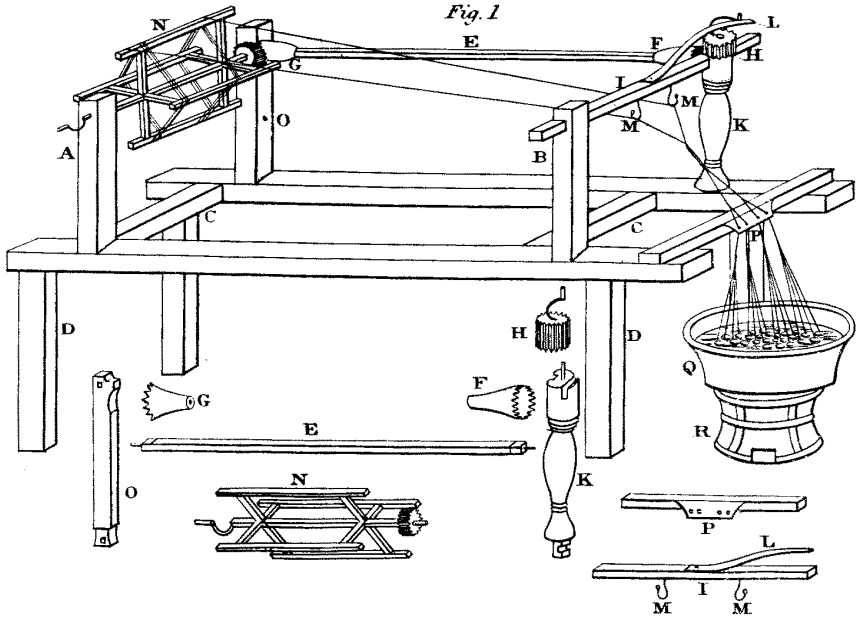


Fig. 2.

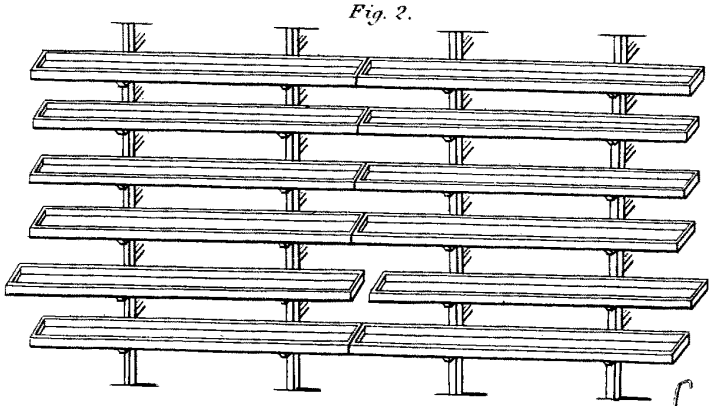


Fig. 7.

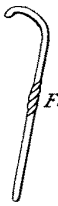


Fig. 4.

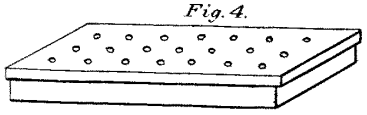


Fig. 6.

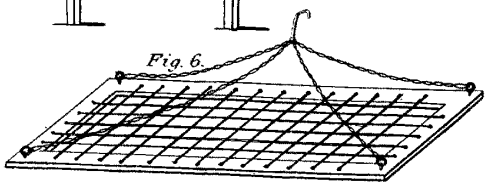
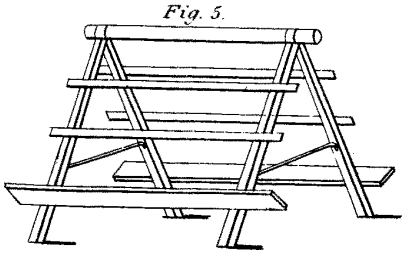


Fig. 5.



Double Chopper

Fig. 3.

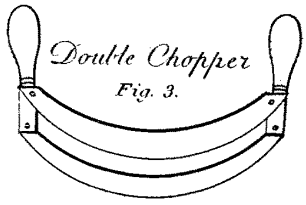


Fig. 2.

Indigo Cradle.

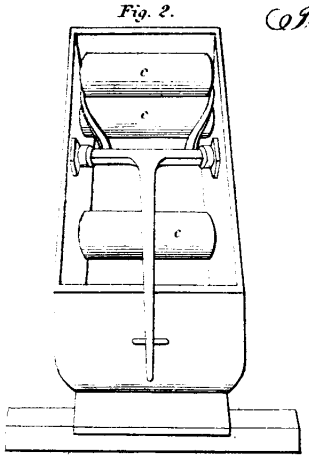
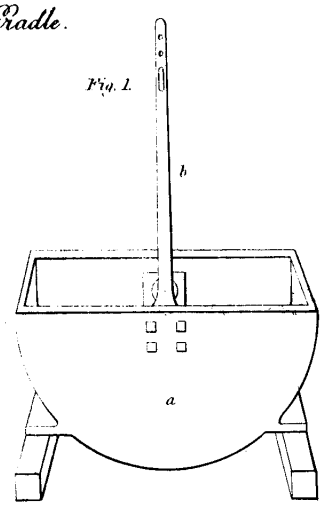


Fig. 1.



Rattan Slides for silk worms.

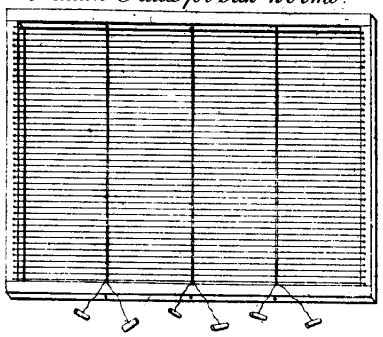


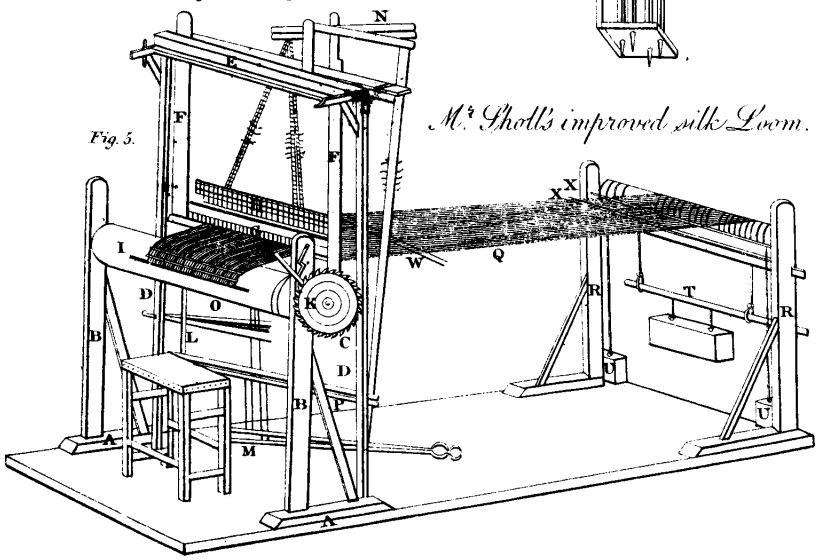
Fig. 3.

Fig. 4.

Cocoon frames.

Fig. 5.

Mr. Sholl's improved silk Loom.



machinery can be, and often is, employed from three to six hours after the hands have left work. When water-power is used, the portion of the silk-machinery which contains the swifts, generally works all night without being tended.

NATURE AND OPERATIONS OF A SILK FACTORY.

The silk worm was first rendered serviceable to man in China, about 2700 years before the Christian era. From that country the art of rearing it passed into India and Persia. It was only at the beginning of the sixteenth century that two monks brought some eggs of the silk worm to Constantinople, and promulgated some information on the growth of the caterpillars. This knowledge became, under the emperor Justinian, productive of a new source of wealth to the European nations. In 1564, Traucat, a common gardener of Nismes, laid the first foundation of a nursery of white mulberry trees, with such success as to enable them to be propagated within a few years over all the southern provinces of France.

This insect is first an egg, which the warmth of spring brings forth: and this, as it enlarges, progressively casts its skin three or four times, according to the variety of the insect. This caterpillar at the end of twenty-five or thirty days having attained maturity of size, ceases to eat for the remainder of its life, merely discharges its excrementitious matter by spinning a cocoon, within which it is changed into a chrysalis. In fifteen or twenty days they come out, a couple of butterflies, male and female.

The eggs of the silk worm are covered with a liquid, which glues them to the piece of paper on which the female lays them; and they may be freed from it by dipping them in cold water, and afterwards drying them. They should be preserved at the temperature of from 54° to 59° Farenheit. When the heats of April begin to be felt, they must not be suffered to act on the eggs, because they would bring on incubation before the first shoots of the mulberry have come forth to supply food to the young worms. This period should be kept back also, becanse it is proper to hatch almost all the eggs together, or at least in successive broods corresponding to the extent of the breeding establishment. The eggs may be laid in a stove room, and exposed to a warmth gradually increasing, till it reaches the temperature of 86° Fahrenheit, at which it must be kept stationary. Nature finishes the work of incubation in eight or ten days. The teeming seed is now covered with a sheet of paper pierced with holes, about one twelfth of an

inch in diameter, through which the young worms creep upwards instinctively to get at the mulberry leaves previously placed above. Whenever the leaves become loaded with worms, they are transferred to plates of wicker work covered with grey paper. This transfer is repeated twice every day.

In the course of from forty-eight to seventy-two hours the whole of the eggs should be hatched. The nursery for breeding the worms ought to be a well aired apartment, free from damp, cold, and excess of heat, from rats and other destructive vermin. For breeding twenty-one ounces avoirdupois of seed, the chamber should be thirty-three feet wide by eighty feet long, and be provided with fire-places for heating and ventilating it; the window casements should be glazed. The temperature must not be allowed to fall under 66° Fahrenheit; it may be raised to 92° Fahrenheit, or even higher; but from 68° to 86° Fahrenheit, is the ordinary range. A current of air should be admitted to purify the atmosphere from the fetid emanations of the caterpillars, their excrements, and the decayed leaves. Light is nowise unfavourable; but may be regarded as in some respects advantageous. A spare room should be set apart for the diseased worms.

A few osier mats may suffice while the worms are young, but more are required in proportion as they grow larger, to prevent their getting piled on each other. The supply of leaves must be proportional to the age of the brood, and ought to be increased when nothing but their ribs are left. The very young should be fed with leaves minced small, and should not be troubled with the removal of the litter, which is trifling. At a future stage it must be removed with delicacy, to give the worms more air, on the new wicker frames, without parting them too far.

Before each moulting, the worm has a keen appetite, but during that process it loses it entirely, and falls into a languid state, from which it immediately revives on casting its skin. The pieces of paper are withdrawn from the bottom of the wicker-frames to permit a free transmission of air between their interstices, whenever the worms have become large enough not to fall through them. After the second moulting, they are half an inch long, and may then be transported from the smaller apartment, in which they are hatched, into the larger one, where they are to be reared to maturity. They must be well cleaned from the litter on this occasion, laid upon fresh leaves, and supplied with a succession of them, cut in pieces, every six hours. After the third moult, the worms may be fed with entire leaves; for they are then extremely voracious, and must not be stinted in their diet. The same remark is still more

applicable to the period after the fourth moult. The heat should now be limited to 68° or 70° Fahrenheit. In every period of their existence, the silk worms are liable to a variety of diseases, under which they derive benefit from the exposure of portions of chloride of lime in their nurseries. When they have reached the fifth stage, they cease to eat; they void their excrements, diminish in bulk, become somewhat semi-transparent, abandon the leaves, try to crawl on the upright posts, and to conceal themselves in corners. These symptoms indicate the development of the spinning instinct. Green oak twigs are to be laid in parallel rows on the wicker tablets in the form of little alleys, eighteen inches wide, with their little ramifications interwoven above. The worms of two tablets are to be collected on one, and freed from all their litter. Little coils of paper and of wood shavings are placed alongside of the diligent worms first, and, after a while, of the lazier ones. The creature sets itself to construct its cocoon, throwing about its thread in different directions, forming the floss, filoselle, or outer open net work. But it soon begins its regular operation of winding round about, in nearly parallel lines, a fine thread into an egg-shaped form, in the centre of which the caterpillar sits at work. The matter of the silk is liquid in the body of the worm, but it hardens in the air. The twin filaments, which the animal always spins through its double tubular mouth, are agglutinated by that liquid cement. The same matter may be extracted in a lump from the body of the worm, and drawn out artificially into a thin transparent web, or into threads of variable diameters. The cocoons are completed in the course of three or four days, after which they must be removed from the branches and sorted, the finest being reserved for seed worms. The cocoons which are to be unwound must not be allowed to remain with the worms ten or twelve days alive within them; for if the chrysalis has time to come out, the cocoon would be cut through, and be useless. The animal must be killed by suffocation, which is effected either by exposing the cocoons for five days to the sunshine, by placing them in a hot oven, or in the steam of boiling water.

The erection of the first mill in England for the manufacture of silk was at Derby. The original mill, called the Silk Mill to denote its pre-eminence, being the first and largest of its kind ever erected in England, stands upon an island in the river Derwent. Its history remarkably denotes the power of genius, and the vast influence which even the enterprises of an individual has on the commerce of a country. The Italians were long in the exclusive possession of the art of silk throwing, and the merchants of other

nations were consequently dependent on that people for their participation in a very lucrative article of trade, and were frequently deprived of their fair profits by exorbitant prices charged for the original material. This state of things continued till the commencement of the last century, when a person named Crotchet erected a small mill near the present works, with an intention of introducing the silk manufacture into England; but his machinery being inadequate to the purpose, he quickly became insolvent, and the design was for some time abandoned. In the year 1715, a similar idea began to expand in the mind of an excellent mechanic and draughtsman, John Lombe, who though young, resolved on the perilous task of traveling into Italy, to procure drawings or models of the machines necessary for the undertaking. In Italy he remained some time, but as admission to the silk-works was prohibited, he could only obtain access by corrupting two of the workmen, through whose assistance he inspected the machinery in private; and whatever parts he obtained a knowledge of during these visits, he recorded on paper before he slept. By perseverance in this mode of conduct, he made himself acquainted with the whole; and had just completed his plan, when his intention was discovered, and his life being in extreme hazard, he flew with precipitation, and took refuge on ship-board. The two Italians who had favoured his scheme, and whose lives were in equal danger with his own, accompanied him, and they all soon landed in safety in England: this happened in 1717. Fixing on Derby as a proper place for his purpose, he agreed with the corporation for an island, or swamp, in the river, 500 feet long, and 52 wide, at a rent somewhat below £8 yearly. Here he established his silk-mill; but during the time employed in its construction, he erected temporary machines in the town-hall, and various other places; by which means he not only reduced the prices of silk far below the Italians, but was likewise enabled to proceed with his great undertaking, though the charges amounted to nearly £30,000. In the year 1718 he procured a patent to enable him to secure the profits thus arising from his address and ingenuity, for the term of fourteen years; but his days verged to a close, and before half this period had elapsed, treachery and poison had brought him to the grave. The Italians, whose trade rapidly decreased from the success of the new establishment, were exasperated to vengeance, and vowed the destruction of the man whose ingenuity had thus turned the current of their business into another channel.

It is in the production of the patterns of silk goods, that the French have a decided advantage over the British; they probably

have little or none after the design is put into the loom. The modes in which taste is cultivated at Lyons deserve particular study and imitation in this country. Among the weavers of the place, the children and every body connected with devising patterns, much attention is devoted to every thing any way connected with the beautiful either in figure or colour. Weavers may be seen in their holiday leisure gathering flowers, and grouping them in the most engaging combinations. They are continually suggesting new designs to their employers, and are thus the fruitful source of elegant patterns. There is hardly any considerable house in Lyons, in which there is not a partner who owes his place in it to his success as an artist. The town of Lyons is so conscious of the value of such studies, that it contributes 20,000 francs per annum to the government establishment of the school of arts, which takes charge of every youth who shows an aptitude for drawing, or imitative design of any kind, applicable to manufactures. Hence all the eminent painters, sculptors, even botanists and florists of Lyons, become eventually associated with the staple trade, and devote to it their happiest conceptions. The French manufacturer justly considers that his pattern is the principal element of his success in trade; for the mere handiwork of weaving is a simple affair, with the improved Jacquard loom. He therefore visits the school, and picks out the boy who promises, by taste and invention, to suit his purpose the best. The French weaver prides himself upon his knowledge of design; he will turn over several hundred patterns in his possession, and descant on their relative merits, seldom erring far in predicting the success of any new style. By this disposition the minds of the silk-weavers in France become elevated and refined. In flower patterns, their designs are remarkably free from incongruities, being copied from nature with scientific precision. They supply taste to the whole world in proportion to the extent of their exportations. There are also weaving schools; in these, a pattern being exhibited, they are required to exercise their invention as to the best means of producing the design on a piece of silk goods. Their superiority in art is turned to good account in many other manufactures.

England beheld, with no small degree of jealousy, the prodigious plantations of mulberry trees in France, the increasing production of silk, and the consequent multiplication of silk manufactures. James I. accordingly endeavoured to introduce this industry into his own kingdom; and, in 1608, a most earnest appeal was made to the British public, in regard to the advantages that might be

derived from the plantation of mulberry trees; but nothing was done: and only as late as 1820, was this subject seriously taken up; some inconsiderable experiments having sufficiently established the fact, that these trees, and the precious insects which feed upon them, thrive as well in England as in France. But long before that epoch, silk manufactures had flourished, to a considerable extent, in England; the raw silk being imported from Italy. There existed already, in 1629, so many of these establishments in London, that the weavers of the city and of the environs were divided into corporations; and, in 1661, the individuals which composed them were more than 40,000 in number.

The revocation of the edict of Nantes, in 1685, contributed greatly to the future progress of this industry; the most skilful French weavers having taken refuge in England. Next to this cause of the rapid progress of this manufacture, must be mentioned the silk machine erected at Derby, in 1719. The reputation of the English fabrics increased at length to such a degree, that even in Italy English silk commanded a higher price than the Italian.

Silk has long been a profitable production of Georgia, and other parts of the United States;* and may be increased, it is presumed, as fast as the demand will rise. This is the strongest of all raw materials, and the great empire of China, though abounding with cottton, finds it the cheapest clothing for her people.

Tench Coxe says, (1789):—"We have a large nursery of the white Italian mulberry established here this summer. Within ourselves, little can be expected; but the idea of the nursery has been encouraged upon this principle, that it prepares things for an emigration from a silk country. This, perhaps, is refining, but the expense is small; the trees are wanted to replace those destroyed by the British army; and the measure falls in with our plan, to foster and encourage, but not to force, manufactures."

* *Extract from a description of Carolina*, 1727. *By Daniel Coxe, Esq.* —"The father of Daniel Coxe was the first proprietor of the English province of Carolina. The vast trouble and expense of Governor Coxe, will scarcely be credited; for he not only, at his sole charge, for several years, established and kept up a correspondence with the governors, and chief Indian traders in all the English colonies, on the continent of America, employed many people on discoveries, by land, to the west, north and south of this vast extent of ground, but likewise, in the year 1698, he equipped and fitted out two ships, provided with above thirty great guns, sixteen patereroes, abundance of small arms, amunition, stores and provisions of all sorts, not only for the use of those on board, and for discovery by sea, but also for building a fortification, and settling a colony by land; there being, in both vessels, besides sailors and common men, above thirty English and French

HISTORICAL SUMMARY OF THE ART OF DYEING.

The desire of attracting public admiration may be observed even in the least civilised state of society. Among the means of distinction which are eagerly laid hold of, the glare of colours is one of the most obvious. The art of dyeing, therefore, has unquestionably a very ancient origin; for when nature afforded colouring substances of easy application, there might arise, among people but slightly civilised, methods of dyeing which have been sought after by polished nations. Thus the Gauls prepared some dyes which were not disdained by the Romans. But for its enlargement and perfection, the art required to follow the progress of manufactures and luxury. The Egyptians had discovered a mode of dyeing analogous to that of our printed calicoes. Cloths, impregnated probably with different mordants, were plunged in a bath in which they assumed different colours.

It is to Greece that our attention turns when we wish to ascertain the progress which the human mind has made in antiquity.

volunteers, some noblemen, and all gentlemen. One of these vessels discovered the mouth of the great and famous river, Mississippi, entered and ascended it above one hundred miles, and would have had perfected a settlement therein, if the captain of the other ship had done his duty and not deserted them. They however took possession of this country in the king's name, and left, in several places, the arms of Great Britain affixed on boards and trees for a memorial thereof. This was the first ship that ever entered that river from the sea, or that perfectly discovered or described its several mouths, in opposition to the boasts and falsities of the French, who assume to themselves the honour of both; Providence seeming to reserve the glory, of succeeding in so noble an enterprise, to the zeal and industry of a private subject of England, which was twice, in vain, attempted by Louis XIV. of France, the most ambitious and powerful monarch of Europe. King William promised Governor Coxe to assist him in settling the province, but died before the accomplishment of his design.

"To the king's most excellent majesty,—'In obedience to your majesty's commands, signified to us by the right honourable Secretary Vernon, upon the petition of Dr. Coxe, in relation to the province of Carolina: We have considered his petition, and humbly crave leave to represent unto your Majesty, that your Majesty's Attorney General, upon the perusal of letters patent, and conveyances produced to him by Dr. Coxe, has reported to us his opinion, that Dr. Coxe has a good title, in law, to the said province of Carolina, extending from 31 to 36 degrees of north latitude, inclusive, on the continent of America, and to several adjacent islands.'

"Signed, STAMFORD, LEXINGTON, P. MEADOWS, WM. BLATHWAIT, JOHN POLLEXTREN, ABRAHAM HILL, GEORGE STEPNEY.

"*Whitehall*, December 21, 1699."

The petition was signed, D. COXE.

Ever since philosophy has taken observation for a guide, and, abandoning the illusions of systems, has adhered to the study of the phenomena of nature, and of the real properties to which they owe their origin, it has followed the chain of the numerous wonders which it has analysed, in subserviency to the welfare of society. It has recognised in manufacturing industry, as well as in commerce, the source of the prosperity of the nation, the germ of a great population, the principal support of agriculture. National industry is augmented and enlightened by a free communication of the processes it employs. India is the nursery of that knowledge and those arts which were subsequently diffused and improved among other nations.*

ON DYEING COTTON AND SILK.

To dye skein cotton yellow.—The same operations as those in the first common red dye are to be used here; to one pound of cotton four ounces of roche alum, and from one to four pounds of weld.

When dyed the cotton is to be worked in hot, but not boiling, liquor, consisting of four ounces of sulphate of copper to every pound of cotton; it is then to be boiled for three hours in a solution containing four ounces of soap to every pound of cotton.

When a dark or *jonquil colour* is wanted, no alum is used; of weld take two pounds and a half, very little verdegris, or a little alum in its stead, but nothing else. For brightening, however, boiling in a solution of soap is in all cases necessary.

On dyeing and re-dyeing cotton furniture yellow.—If the furniture, such as rough or finished cotton or cambric, intended for yellow linings for bed or window curtains, be in a perfect bleached state, which is now generally the case, according to the number of the pieces so must the size of the copper be to boil the weld in for the yellow dye. A small copper holding four or five pails would do for three pieces of twenty-eight yards each. The weld may be purchased by the half bundle, the bundle, or the load. Half a bundle would be enough for the above quantity of cotton, if a moderate yellow is wanted. The weld must be increased or decreased according as the pattern approaches a straw, a canary, a lemon, or towards a gold colour or orange.

The weld must be boiled about twenty minutes, the liquor then strained off

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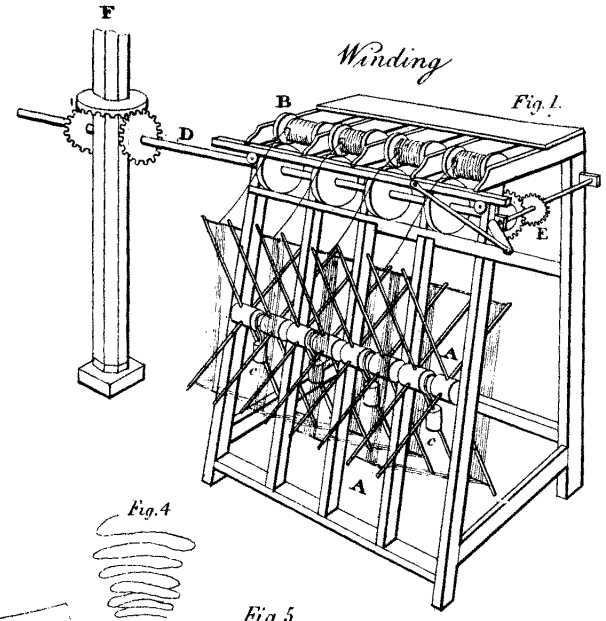
* Mr. John Wilson, of Ainsworth, near Manchester, an extremely ingenious dyer and manufacturer, who more than sixty years since gained both celebrity and wealth by the great improvements he introduced into the art of dyeing, had obtained from the Greeks of Smyrna the secret of dyeing Turkey red, which he described in two essays; but it is stated that he found this too tedious and expensive a process, less suited to manufactured goods than to cotton in the skein, nor even suited to that spun upon the single spindles then in use, though it might be applicable to that spun on machines.

Winding

Fig. 1.



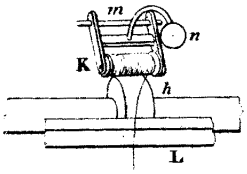


Fig. 3.

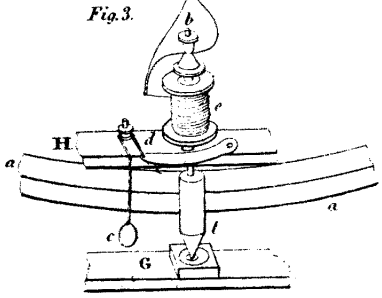
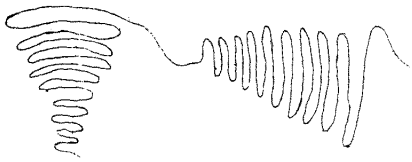


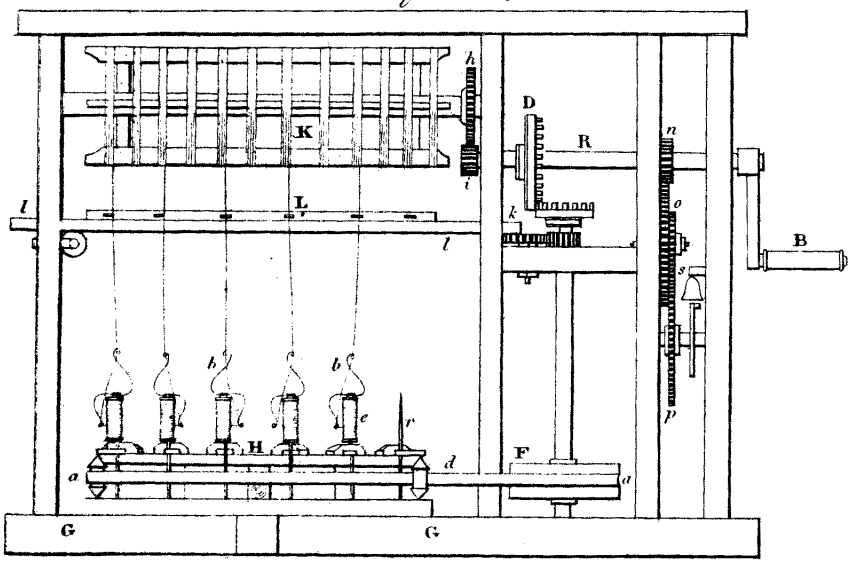
Fig. 4

Fig. 5

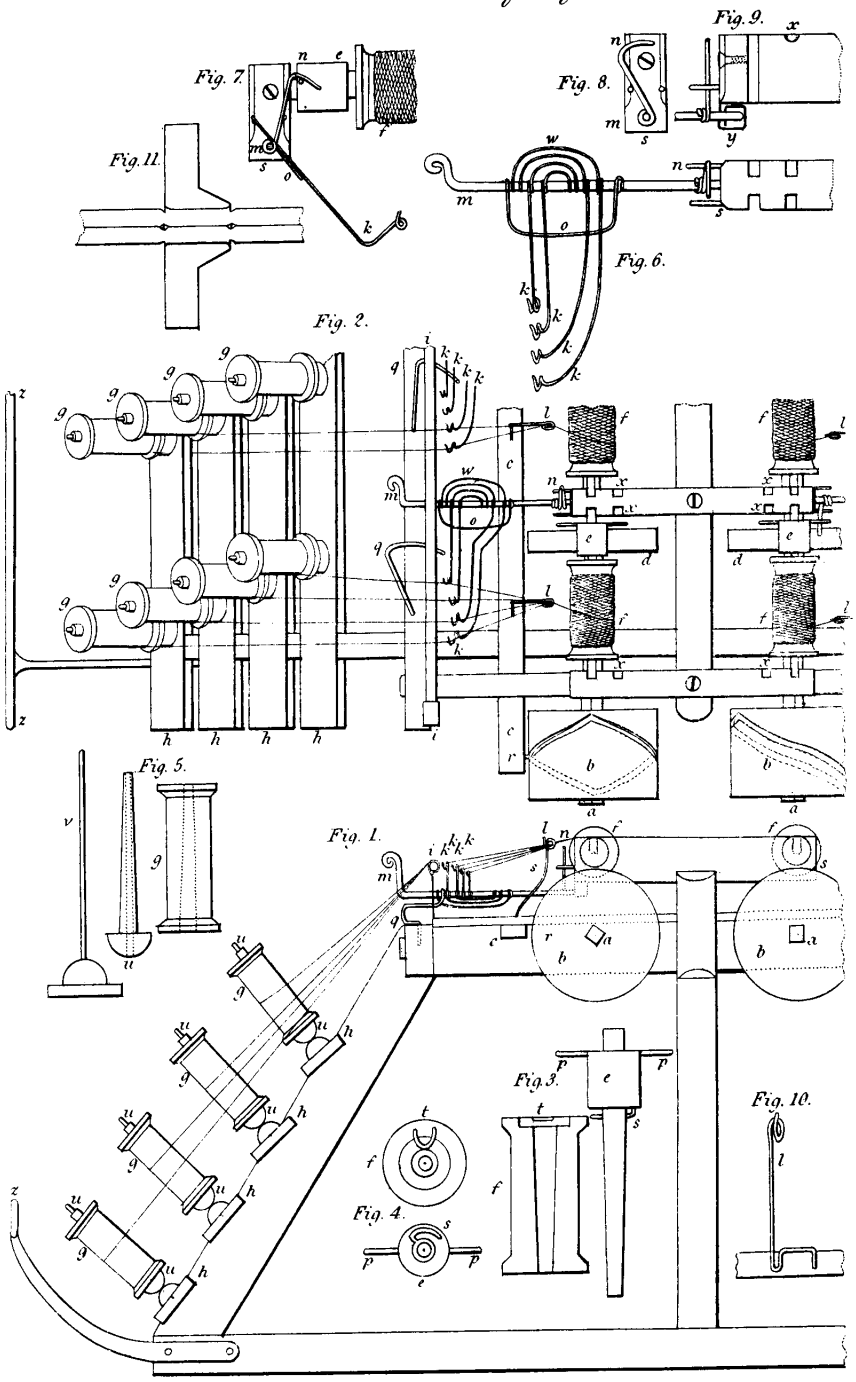


Throwsting

Fig. 2.



Shenton's Tramming Engine.



into a proper tub, and the weld boiled again. While the boilings are going on, three tubs, being wine pipes cut in two, must be got ready, and made particularly clean, being also previously seasoned for the work. One is to receive the boiled weld with some cold water to regulate it to the heat which the hand will bear; the other is for water, and as much alum liquor as will colour it and make it taste strong; and the third is to contain clear water to wash the furniture off.

Whatever yellow is in *fashion* (or indeed any fashionable colour,) has commonly a *fashionable name.* But if the dyer can, by his experience, proportion his drugs to the weakest, and from that to the strongest shade, let the name be what it may, after he has a set of patterns of his own dyeing, he will see, upon the first sight of any colour, how to set about it.

In the present instance let the pattern be a moderately pale colour of yellow; then put all the first boiling of the weld in the first tub, and cool down as above directed. Two or three persons should then work the pieces quick from end to end by the selvages; that they may be even, two may do this; one of whom must be an expeditious hand to work them and keep them even. When they have been edged over six or seven times, they are to be folded upon a board laid over the tub, and wrung as dry as possible by two persons. When they are all out, they are passed in the same manner through the tub of alum, and, after six or seven turns, they are to be taken out of the alum liquor, wrung as before, and then washed off.

By this time the second weld liquor will be boiled; some of the first must be thrown away, and the second weld liquor added in its place. The goods are then passed through as before, and wrung out; the alum liquor being strengthened, they are passed through it, wrung out as before, and then washed off: the water in the wash tub having been changed.

In some instances verdegris is used instead of alum; and in other cases it is used in addition to the alum. For some shades old fustic is used instead of weld, and sulphate of copper instead of verdegris.

The alum solution, and the sulphate of copper, and the verdegris, or acetate of copper, should be always ready. It is necessary to have a tub for each, in size proportioned to the work to be done; but larger for the alum than for the other two.

Sulphate of iron is also used in some dark grays, browns, slates, and in all blacks; this will require a tub as large or larger than that for alum.

When the yellows are dyed and wrung as dry as possible, they should be taken into a close room or stove to dry, particularly in London, because of the smoke, especially in winter. A German, or other stove, should be placed in the room, the size of which, as well as the number of the stoves, must be regulated by the quantity of work. When the goods are dry they must be sent to the calenderers, if directed to be calendered; but the general and better way is to stiffen them with starch after they are dyed, and before they are dry; and when dry they should be sent to the glaziers, instead of the calenderers, except when both branches are carried on by the same person.

When furniture, originally yellow, has become faded, it may be re-dyed thus: in this case it should be dyed rather of a fuller shade than the original. A large flat tub, such as described above, is to be filled three parts full of water, to which sufficient sulphuric acid must be added to make it taste strongly sour. After being well stirred, the pieces are to be put in,

and worked in this sour liquor; and the yellow dye in consequence is stripped off. If the acid liquor be not strong enough, more acid must be added, with the precaution of well mixing it with the water, and the goods must be passed through the liquor again: by these means the yellow is discharged. They are then to be taken out on a board upon the tub and wrung by two persons; then to be washed off and wrung, washed and wrung again, when they are fit to be dyed.

It is still to be remembered that any faded or worn out colour, or that goods more or less decayed, seldom become so bright as the colour which a new piece of goods receives from the same dye.

Some cloths for re-dyeing require the application of oxymuriate or chloride of lime to discharge their colours, particularly when madder, galls, &c. form the constituent parts of the dye. In this case if a *bleacher* be near it might be best to let him perform the process with the oxymuriate of lime; not only from the pernicious nature, but also from the expense of it, which, unless the business be upon a large scale, will not pay the dyer for his trouble.

However, if the dyer thinks proper to perform this operation, then the oxymuriate of lime or bleacher's ashes, &c. may be obtained at the dry-salters and dissolved in a cask, and the clear liquor used in proportion to the quantity of goods, the colour of which is intended to be discharged, which, when done, should be washed off in two waters at least before they are dyed.

To dye cotton skein a duck's wing green and olive.—This is performed by a blue ground, next galling, dipping in the black vat, then in the weld dye, then in verdegris, remembering to wash off previously to performing each process.

Olive is to be performed with weld or old fustic, verdegris, and Brazil wood.

Of browns, marcons, coffee colours, &c.—It would answer little purpose to enlarge this treatise with a detail of all the possible methods of producing the various shades of these several colours, the whole consisting in the use of galls, verdegris, sulphate of copper, weld, and madder.

By welding a stuff previously maddered for *red* you may produce a *gold* colour; and by dipping the same red in a blue vat you obtain a *plum* colour.

Observations on silk.—Silk as it is obtained from the cocoons of the worm, is generally of an orange or yellow colour, more or less dark; in the south of France it is generally very dark: its natural shade is unfavourable to all other colours. It is also imbued with a kind of varnish or gum, which makes it stiff and hard; this stiffness is improper in the fabrication of most silk stuff, it is therefore *ungummed*, as it is called, by the following processes:—

On ungumming and boiling silk.—Observe, that throughout the following processes for silk *white* soap is directed to be used; and, generally speaking, we believe it will be found the best, more especially for the more delicate operations. Yet Mr. M'Kernan, in his process for ungumming silk, directs yellow soap and soft soap in equal parts, and of the same weight as the silk to be used: he adds, however, that different sorts of silk require more or less soap; the best rule he finds, nevertheless, is *the same weight*

of soap as of silk; and he says also, that yellow soap and soft soap of the best quality he finds the best for this purpose.

The silk is divided into hanks, each hank is tied with a string, several of these are tied together (a handful of them) by putting a piece of string through each separate skein, and tying the piece of string in a long tie, to slip easily when they are wanted to be untied.

A liquor is prepared of thirty pounds of *white* soap to a hundred pounds of silk; the soap is cut into small pieces and boiled in water, when it is dissolved the fire is damped.

While the liquor is preparing, the skeins of silk are put on rods; as soon as the soap liquor becomes a little below boiling heat (for it should not boil, as boiling would tangle the silk) the silk is to be put into it in an oblong copper, being nearly full; it is to remain in the liquor till its gummy matter has left it, which will be seen by its whiteness and flexibility. It is then turned end for end on the rods, that the part above the liquor may undergo the same operation. As soon as this is accomplished the silk is taken out of the copper, the hanks which were first turned being soonest done.

The hanks are now to be taken from the rods to the peg, disentangled, and nine or ten of them put on one cord, this cord passing through the string that tied each hank. When the whole is corded it is put into pockets of coarse strong white linen, fifteen inches wide and five feet long, closed at each end and on one side; when the silk is put in, the pocket is sewed all along the other side with packthread, and fastened with a knot; four pockets will hold the whole hundred pounds.

The pockets being thus ready another liquor is prepared like the first. When ready, and the boiling checked with cold water, the pockets are put in and boiled well for a quarter of an hour, checking with cold water in order to prevent its boiling over; it is necessary also to turn the bags about often with a pole, or rather let two persons have a pole each for this purpose. This operation is called boiling.

In addition to the processes of boiling with soap, as above directed, Mr. M'Kernan recommends that the silk should be winched through a copper of water at the heat of 160°, having two pounds of soda (barilla) dissolved in it, then winch or wash in water, and wring and dry.

In the boiling of silks for common colours twenty pounds of soap will do for a hundred weight of silk; but, as in this case, the silk is not ungummed, it should boil for three hours and a half, adding water to supply the evaporation.

The silks intended for the greatest degree of white, either to remain white, or for the fabrication of white stuff, are boiled twice in soap and water; those that are to be dyed of different colours are boiled but once, and with a smaller quantity of soap, because the little remaining redness is by no means prejudicial to many colours. Different quantities of soap are, however, necessary for different colours.

Silk designed for blue, iron gray, brimstone, or any other colour requiring a very white ground, should be done according to the preceding process, and have thirty pounds of soap.

When the silk is boiled it is taken out of the copper by two men with poles, and placed in a clean barrow; they are then taken to a long shallow trough, from which the water may run away, the pockets are opened, and

the silks examined; such as have yellow or lemon colour spots remaining are boiled again for some time, till the spots are removed. After unpocketing, the whole is dressed on the pegs.

Silk loses from twenty-five to twenty-eight per cent. of its weight in ungumming and whitening. The bags of silk should never be suffered to lie long together before they are emptied after being boiled, as their doing so would make the silk hard.

White silk, as before observed, is distinguished into five principal shades, namely, *China white*, *India white*, *thread* or *milk white*, *silver white*, and *azure white*.

The three first are prepared and boiled as has already been shown. Silver and azure white in the preparation or ungumming, thus: take fine powdered indigo, put it into water boiling hot, when settled the liquor is called *azure*.

To azure the silk it is taken from the ungumming copper after it is dressed and put into a trough of water; after it is worked, drained, and again dressed, it is ready for the whitening.

Whitening.—Put into a copper with thirty pails of water half a pound of soap; when it boils, and the soap dissolved, add for *China white* a little *prepared annatto*. The silk, being on rods, is now to be put into the copper, and kept turning end for end without intermission till the shade is uniform. For *India white* a little azure is added, to give the blue shade: for *thread white* and others a little azure is also to be added.

Observe, the liquor should be very hot, but not boiling; the turnings five times repeated, by which the shade is made even. When finished, it is taken out, wrung, spread on poles to dry, and that part of it required for sulphuring must be put upon rods or slight poles.

Sulphuring.—The hanks, being upon poles seven or eight feet from the ground, in an appropriate room, one pound and a half or two pounds of roll brimstone will sulphur a hundred weight of silk.

Put the brimstone, coarsely powdered, into an earthen pipkin with a little charcoal or small coal at bottom. Light one of the bits with a candle, which will kindle all the rest.

The room should be close, the chimney, if any, being closed up; the sulphur should burn under the silk all night. The next morning the windows should be opened to let out the smoke and admit the air, which, in summer, will be sufficient to dry the silk; but in winter, as soon as the sulphurous fumes are dissipated, the windows must be shut and a fire kindled in the stove or stoves to dry the silk.

Observe, if the room for sulphuring does not admit of openings sufficient for the dissipation of the sulphuric fumes, the work-people will be in danger of suffocation.

When the sulphur is consumed it leaves a black crust which will light the future sulphur like spirit of wine.

If, in dressing, the silk sticks together, it is not sufficiently dry.

Samuel Wetherill

The First Manufacturer of Fustians and Jeans in America.

APPENDIX.

I visited the building where S. Wetherill carried on his manufactory of velverets, fustians, &c.; and by conversation with his descendants, I found that he was most enthusiastically engaged in producing goods, so as to render the colony independent of England. He was one of those worthy men, who entered, with all their souls, into the cause of liberty, and in consequence of the peculiar views of the Friends on the subject of war, he was disowned; as he maintained, in that particular exigence, the lawfulness of defensive operations. Nothing moved from his general religious principles, and being a decided advocate of civil and religious liberty, he commenced a society, still in existence in Philadelphia, called the Free Quakers.

From a perusal of his publications, I find him a faithful enquirer after truth and righteousness; swayed by no consideration, but a conviction of his own mind and the good influence of principles. He lived in a time which tried men's souls, and he bore the trial with firmness and patience; and manifested to the last an unwavering patriotic spirit, religiously maintained while his valuable life was spared. He lived to see the fruits of independence, in the extension of national prosperity; and in the progress of freedom, science, and truth. I was pleased to obtain the following original letter, which is characteristic of his kind feelings and liberal sentiments; and I regret that my limits will not allow me to give a fuller account of this pioneer in American industry.*

BALLSTON, July 26, 1809.

My dear Rebecca,

I wrote to thee from New York the next day after our arrival there, the second day of the week following we set off for Albany in the steam boat: the scenery all the way up the river is the most curious, grand, and beautiful I ever beheld; the shore being high mountains of rocks, little villages, and towns, and the remains of divers fortifications made in the late revolution, including the celebrated Stony Point, which General Arnold intended to betray into the hands of General Howe, and a great number of beautiful country seats and plantations. We left Albany the next day after our arrival, and came to Ballston the same day; we have had a great deal of company and a variety of amusements for such as have a relish for them. The evening before last there was a ball given in compliment to the governor of Mas-

* Mr. Wetherill also carried on the business of dyeing and fulling in South Alley; also chemical works. His ancestor, came to New Jersey before Wm. Penn's arrival in Pennsylvania, and before the war of the revolution he moved to Philadelphia, where he followed his trade as a carpenter, and was so decided a Friend to the cause of independence, that being disowned by the society of friends for asserting the lawfulness of defensive war, which he defended with his pen, he with others formed a new society; and being presented by the legislature with a lot at the corner of Mulberry and Fifth street, they erected a brick house of worship, which still remains.

sachusetts, who was here on a visit. The company are genteel people who have come far and near; from New York, Boston, Carolina, Georgia and Philadelphia. Great numbers are benefited by the waters together with the amusements combined. I suspect that the journey and amusements are a principal article in restoring health, the ball especially; but I have received no benefit from any or all of those means—simply trusting to the waters, which do not appear to have done me any good, my weakness still continuing much the same.

Farewell, my dear child, from thy grandfather; I have a most miserable pen, which, together with my weakness, makes it impossible to write intelligibly. Thy grandmother sends her love to you all.

(Signed) SAMUEL WETHERILL.

From a review of "Colden's Life of Fulton," published in the New York Monthly Magazine, the following interesting extracts are made:—ROBERT FULTON was born, of Irish parents, in Little Britain, in the county of Lancaster, Pennsylvania, in 1765. His family is said to have been respectable but not rich. Mr. Colden says, that his peculiar genius manifested itself at an early age, and that his leisure hours in childhood were spent in mechanics' shops, or devoted to the pencil. The latter employment seems at that time to have possessed the greatest attractions, for, from the age of seventeen to twenty-one, he painted portraits and landscapes, at Philadelphia, for profit. He then purchased, with his little earnings, a little farm in Pennsylvania, upon which he established his mother. We rejoice to record this circumstance, as we can scarcely conceive one more honourable to the character of a young man. It proves early industry, frugality, and great strength of filial affection. In the same year he went to England to improve himself in his profession, as a painter, under the patronage of Mr. West. He was for some years an inmate in the family of that gentleman. After leaving it, he removed to Devonshire, and remained in that place, and in other parts of England for some years longer—it does not clearly appear how many—and then went to France. During the latter part of his stay in England, he seemed to have relinquished his profession, and to have busied himself about several projects relating chiefly to canal navigation. In 1793, he addressed (we presume from France) some general speculations on French politics, to Lord Stanhope, who appears to have been his friend, but though designed for the public, they attracted little of the public attention, as his biographer does not even know whether they were ever in fact

* The following letter has induced me to select the above notice.

ASHLAND, 4th July, 1835.

SIR:—I received your letter transmitting a copy of your prospectus, for the publication of a memoir of the late Mr. Samuel Slater. I have been highly interested by what I have heard from time to time, of his early and successful exertions to introduce the cotton manufacture in the United States; and I have now in my possession some cotton yarn spun by the first spindles which he put up, which I was informed were the first used in the United States. Without being able to contribute to the accomplishment of your undertaking, I shall be glad to hear of its successful execution. The names of Fulton, Evans, Whitney and Slater, should ever live in the grateful recollection of the people of the United States. With great respect,

I am, your ob't servant,

Mr. George S. White, Canterbury, Connecticut. HENRY CLAY.

published or not. In 1797, he took lodging at an hotel in Paris, with Mr. Joel Barlow, with whom he formed so strong a friendship, that when Mr. B. soon after removed to his own hotel, he invited Mr. F. to reside with him. For some years Fulton was a member of the family of Mr. Barlow. He projected a panorama, which proved successful and beneficial, and made some experiments upon the explosion of gunpowder under water. The French directory gave him hopes of patronising these attempts, but at length withdrew their support. He offered the project to the Dutch government, but it was declined. It was then offered to Bonaparte, who had become first consul, and he appointed a commissioner with funds and power to give the required assistance.

While in France, and probably about this period, he formed an intimate acquaintance with Chancellor Livingston, and at that period those gentlemen laboured conjointly in their attempts to introduce steam navigation, which was afterwards attended with such brilliant success. In 1801, he made several experiments with a plunging boat, designed for sub-marine warfare, with a degree of success which seems to have been satisfactory to himself.

The following very flattering account was given by St. Austin, a member of the tribunal:—The diving boat, in the construction of which he is now employed, will be capacious enough to contain eight men, and provision for twenty days, and will be of sufficient strength and power to enable him to plunge one hundred feet under water if necessary. He has contrived a reservoir of air, which will enable eight men to remain under water eight hours. When the boat is above water it has two sails, and looks just like a common boat; when she is to dive, the mast and sails are struck. In making his experiments, Fulton not only remained a whole hour under water with three of his companions, but had the boat parallel to the horizon at any given distance. He proves that the compass points as correctly under the water as on the surface, and that, while under water, the boat made way at the rate of half a league an hour, by means contrived for that purpose. If we may judge of the future from the past, it would seem necessary for the success of these projects, to obtain the consent of those who are to be "decomposed," which has not yet been done. Fulton was, therefore, never able to demolish an English ship, although he watched long and anxiously such as approached the French coast, for that purpose. The rulers of France being at length discouraged, and Fulton thinking that the all-important object was to blow up ships, and so that was effected, it was no great matter to what power they might happen to belong, turned his eyes for patronage to the English government—or they turned their eyes to him. Mr. Colden seems very properly aware that this conduct of his friend might make an unpleasant impression on the minds of those who were not, like his biographer, acquainted with the elevation and philanthropy of his views, and seeks to justify him by the following defence. It must be recollected, that Fulton's enthusiastic notions of the advantages of a universal free trade and liberty of the seas, had led to the inventions which he was then endeavouring to employ, and which as he supposed, would annihilate naval armaments, the great support in his estimation of what he calls the war system of Europe. He was persuaded, that if this system could be broken up, all nations would direct their energies to education, the sciences, and a free

exchange of their natural advantages. He was convinced that if, on the contrary, the Europeans continued to cherish this war system, and to support and augment their great naval armaments, his own country would be driven to the necessity of protecting herself by similar establishments, which, as he thought, would be inimical to her republican institutions, and destructive of her happiness. Without reference, therefore, to the merits of the then existing contest, the grounds of which were constantly changing, without feeling a partiality or enmity to either of the belligerents, he was desirous of engaging one of the nations at war to give him an opportunity of trying the efficacy of his inventions. If they were proved to answer his expectations, he was indifferent as to the temporary advantages it might give either over the other. He believed that the result would be the permanent happiness of all, and that in the general good his own country would largely participate. He considered himself as introducing a new military science, which he wished to prove, and which he had a desire to perfect himself, for the benefit of his country and of mankind. His sentiments on this subject were not novel, nor without the sanction of the nations which they most immediately concerned. Neither France nor England has hesitated to encourage their citizens, with a view to their improvement in military science, to serve in the armies and navies of foreign states at war, where they have been neutral. "Whatever," says Mr. C. "may be the just force of this reasoning, it swayed the mind of Mr. Fulton to honest conviction." It is doubtful whether it will produce a similar effect on any other mind. From the following passage we infer that the negotiations between Fulton and the English ministry were clandestine, and were carried on at a time when he resided in France, and was ostensibly attached to her interests:—"It has been mentioned, that the Earl of Stanhope had taken great pains to inform himself as to Fulton's proceedings in France. This nobleman's mathematical and mechanical mind perceived what consequences might result from the application of Fulton's inventions. The information he obtained was communicated by the British cabinet and excited attention. It was determined by the British ministry, if possible, to withdraw Fulton from France. Lord Sidmouth, who was then one of the ministers, contrived to have a communication with Fulton, while he was in Paris, and obtained his consent to meet an agent of the British government in Holland. In October, 1803, Fulton went from Paris to Amsterdam for this purpose, but the agent with whom he was to confer did not arrive; and after being in Amsterdam three months he returned to Paris. We cannot resist the impression that some light is thrown upon Fulton's conduct by the evidence adduced for another purpose by Mr. Colden from Lord Stanhope, his early friend and correspondent. In a speech on American affairs, made by Lord Stanhope in the house of lords, soon after these experiments were made, he is reported in an English newspaper to have said, 'it was not perhaps sufficiently known, that at that very moment exertions were making in America to carry into effect a plan for the disclosure of which an individual had, a few years before, demanded of the British government fifteen thousand dollars, but had been refused. He alluded to a plan, he said, for the invisible destruction of shipping, and particularly men-of-war. That the inventor of this scheme was then in America, and it was ascertained that it would not, on an average, cost twenty pounds to destroy any ship whatever.' While he was labouring for

his new employers, some of the torpedoes were thrown from British boats upon French vessels, but they exploded without effect—a circumstance which Fulton attributed to a slight, and easily rectified mistake. To evince the correctness of his opinion, in October, 1805, he did blow up with complete success a brig provided for the purpose. Still, however, the British ministry were incredulous, and Fulton, wearied with incessant applications, disappointments and neglect, at length embarked for this country." Mr. Colden here fairly states—it would be doing injustice to the memory of Fulton, as well as that of another ingenious native American, not to notice, before we leave this subject, that Fulton did not pretend to have been the first who discovered that gunpowder might be exploded with effect under water, nor did he pretend to have been the first who attempted to apply it as the means of hostility. He knew well what had been done by Bushnel in our revolutionary war. He frequently spoke of the genius of this American with great respect, and expressed a conviction that his attempts against the enemy would have been more successful, if he had had the advantages which he himself derived from the improvements of nearly forty years in mechanics and mechanical physiology. We cannot but think, that it is a very exaggerated estimate of the efficiency of Fulton's contrivances, which induces Mr. Colden to suppose, that the "British ministry never truly intended to give Fulton a fair opportunity of trying the effects of his engines." The object may have been to prevent their being placed in the hands of an enemy; and if that was accomplished, it was the interest of England, as long as she was ambitious of maintaining the proud title of mistress of the seas, to make the world believe that Fulton's projects were chimerical. Nothing could be more likely to produce this effect, than abortive attempts to apply them. This would prevent other nations from making similar experiments and discourage the inventor. In June, the British ministry appointed a commission to examine Fulton's projects. The commissioners were Sir Jos. Banks, Mr. Cavendish, Sir Home Popham, Major Congreve and Mr. John Rennie. Many weeks passed before Fulton could prevail on them to do any thing, and finally, when they met, they reported against the sub-marine boat as being impracticable. In a letter to the ministry, Fulton complains that this report was made without his having been called for any explanations, and although the gentlemen who made it had before them no account of what had been done. Indeed, in the first interview which Fulton had with Mr. Pitt and Lord Melvile, the latter condemned the Nautilus without a moment's consideration. If these engines were, in truth, terrible as the biographer imagines, it would not be strange that the British ministry should choose to preserve the navy by almost any means from entire demolition; and they might oppose the introduction of a mode of warfare which though, in the first instance, it was exerted against their enemies, would infallibly re-act against themselves with greater effect in proportion to the superiority of their naval force. But no such motives can be ascribed to the French republican government, and they rejected it—no such suspicion can be against Bonaparte, and after a full trial he relinquished it; or against the Dutch government, and they declined it; no such policy is to be attributed to our administration, and still we are told by Mr. Colden, "Mr. Fulton's plan for sub-marine warfare met

with no countenance from the government. He had not been able to inspire the executive officers with any confidence in them."

We presume also, that Commodore Rodgers is not to be accused of connivance in a similar design. Besides, Mr. Colden should have weighed the matter well before he made a charge which necessarily implies that all the experiments made by such men as Mr. Cavendish, Sir Home Popham, Major Congreve and Mr. Rennie, (the commissioners appointed by the British ministry) were intended to be deceptive, and that their report was meanly fraudulent and false. Mr. Colden has so far suffered his imagination to predominate over his better judgment upon this subject, that he seems really to have supposed, that during the late war it was the main object with the British navy to ascertain the part of the coast where Fulton might reside, and to avoid it as the particularly fulminating point of this terrific submerged thunder. Fulton arrived in New York, in December, 1806, and immediately renewed the pursuit of the objects upon which he had recently been engaged in Europe, that is, sub-marine war and steam navigation.

He was encouraged by the American government, and in the summer of 1807, made several experiments, and one of them upon a large bulk brig, (an unresisting subject,) was completely successful. The narrowness of our limits—the necessary length of this article—and the notoriety of these attempts, which were made in the vicinity of New York, render it unnecessary for us to detail them with minuteness. In March, 1810, congress passed an act making an appropriation for trying the use of torpedoes and submarine explosions. Commissioners were appointed to observe the success of the experiments, of which the sloop of war Argus, commanded by Captain Lawrence, was to be the subject. These commissioners differed considerably in their reports of the results to the government—Chancellor Livingston, with whom, as we before mentioned, Fulton had formed a very intimate acquaintance and connection in France, which subsisted during their joint lives, was rather favourably impressed. General Lewis ("whose long military services, and experience," Mr. Colden thinks, "renders his judgment on this subject deserving of the highest consideration") was very sanguine of their ultimate success; and such, also, was the opinion of the biographer, then one of the commissioners. Commodore Rodgers also made a report, which contained a journal of the daily proceedings of Fulton and the committee, and very minute descriptions of the machines and experiments. His opinion was entirely against Fulton's system, and he concludes that every part of it would be found totally impracticable. A great portion of the work is occupied by a statement of Fulton's merits and those of his chief friend and associate Chancellor Livingston, in relation to steam navigation. The information prevalent on the subject—the legal discussions which have already been had, and which may hereafter arise in relation to it—and, to speak honestly, a little distrust of our own judgment, induce us to refrain from a minute examination of the claims which are advanced in favour of those gentlemen. It is but fair, however, to remark, that even if it be admitted that Fulton has done no more than reduce to successful practice previously existing theories upon a subject of such paramount importance, he is entitled to praise enough to fully satisfy the ambition and affection of his friends. The increased facility of intercourse in

many parts of the world, and especially on this continent, is such that twenty years ago it would have required a bold imagination to conceive. Can any man doubt that Fulton has been mainly instrumental in accelerating, if he did not exclusively produce, this state of things? The whole progress of the arts show that the first discovery of a principle is usually very remote from the perfection of the practice. This is strongly exemplified by some facts stated by Fulton himself. In 1320, gunpowder was discovered: one hundred and fifty years after that period, iron bullets were first used; muskets were unknown until two hundred years from the same time; and in these, the cumbrous match-lock did not give place to the fire-locks till the beginning of the seventeenth century, that is two hundred and eighty years after the first knowledge of gunpowder. In the year sixteen hundred and sixty-three, the Marquis of Worcester discovered the expansive power of steam. Thirty-three years afterwards, Savory took out a patent for a steam engine to pump the mines of Cornwall. In seventeen hundred and five, Mr. Newcomen thought of a piston to the cylinder; but he worked at it nine years before it was sufficiently improved to give it a fair prospect of utility. Fifty-two years after Newcomen's discovery, Mr. Watt thought of another improvement, which was the separate condenser. Thus it was an hundred years from the time of the Marquis of Worcester, till Mr. Watt's discovery gave the steam engine, in any degree, its present perfection; and rendered it so simple, familiar, and useful, as to be adapted to the many important purposes to which it is now applied. Another striking illustration to the same effect, and which may serve to exemplify the nature, as well as to manifest the degree of Fulton's benefactions to the public, is to be found in the gradual improvements effected in his steam boats since their establishment. We believe the average passage of the first boat between Albany and this city, fell little short of thirty-six hours, and in some of the present boats, it does not exceed twelve hours. Fulton's attention was strongly attracted, during several parts of his life, to the subject of improving internal navigation by means of canals; and in particular he entered, with his characteristic enthusiasm, into the magnificent project which our legislature is now attempting to realise. In 1811, he was appointed one of the commissioners upon the subject, but he did not sanction the report which in the subsequent year was returned to the legislature. It is not claimed by the biographer, that either this scheme in particular or generally this branch of improvement, has received any eminent benefit from the genius or industry of Fulton. In February, 1814, he addressed a letter to Governeur Morris, president of the board of commissioners, in which he shows what would be the advantages of the proposed canal, and exhibits very interesting and curious calculations of the comparative expense of transportation upon land, upon rivers, and upon canals. The same year, Fulton, with the other commissioners, made another report to the legislature; this is the last service he rendered this magnificent project. We presume that our readers will readily excuse our omission of any account of Fulton's well known and very extensive experiments in relation to the various modes which he devised for submarine attack, and for transferring a large portion of naval warfare beneath the surface of the ocean. We are told by Mr. Colden that the steam frigate, that imposing if not effective engine of war, owes its origin to these experiments, although it is not apparently connected with

them. The untimely death of Fulton; the cessation of the war; and the imperfections inseparable from the infancy of all improvements, may have prevented the full development of the powers which, perhaps, this invention is hereafter destined to display. The occasion and manner of Fulton's death is thus related. In January, 1815, Mr. John Livingston, who owned the steamboat which plied between New York and New Jersey, but which was stopped by the operation of the New Jersey laws, petitioned the legislature of that state for their repeal. After hearing witnesses and counsel for several days, the laws were rescinded. It was upon this occasion Fulton was examined as a witness, as we have before stated. The weather, while he was at Trenton, where he was much exposed, in attending the hall of the legislature, was uncommonly cold. When he was crossing the Hudson to return to his house and family the river was very full of ice, which occasioned his being several hours on the water on a very severe day. Fulton had not a constitution to encounter such exposure, and upon his return found himself much indisposed from the effects of it.

He had at that time great anxiety about the steam frigate; and after confining himself for a few days, when he was convalescent he went to give his superintendence to the artificers employed about her: he forgot his debilitated state of health in the interest he took in what was doing on the frigate, and was a long time, on a bad day, exposed to the weather on her decks. He soon found the effects of this imprudence. His indisposition returned upon him with such violence as to confine him to his bed; his disorder increased, and on the 24th of February, 1815, terminated his valuable life. As soon as the legislature, which was then in session at Albany, heard of the death of Mr. Fulton, they expressed their participation in the general sentiment, by resolving that the members of both houses should wear mourning for some weeks. It will appear from the above slight sketch of the life of this valuable citizen, that the three great subjects of his attention and efforts were, the improvement in the art of making canals, submarine warfare and steam navigation. In relation to the first, we are not aware that he has effected much; in the second, he has displayed great talent and wonderful industry, the effects and utility of which time is hereafter to develope; and in the third he has done what should make his country proud, and the world grateful.

On the Origin of Steam Boats and Steam Wagons, by Oliver Evans.

About the year 1772, being then an apprentice to a wheel-wright, or wagon maker, I laboured to discover some means of propelling land carriages without animal power. All the modes that have since been tried (so far as I have heard of them), such as wind, treadles with ratchet wheels, crank tooth, &c., to be wrought by men, presented themselves to my mind, but were considered as too futile to deserve an experiment; and I concluded that such motion was impossible for want of a suitable original power. But one of my brothers, on a Christmas evening, informed me that he had that day been in company with a neighbouring blacksmith's boys, who, for amusement, had stopped up the touch hole of a gun barrel, then put in about a gill of water, and rammed down a tight wad; after which they put the breech in the smith's fire, when it discharged itself with as loud a crack as if it had been loaded with powder. It immediately occurred to me, that

here was the power to propel any wagon, if I could only apply it, and I set myself to work to find out the means. I laboured for some time without success. At length a book fell into my hands describing the old atmospheric steam engine. I was astonished to observe that they had so far erred as to use the steam only to form a vacuum to apply the mere pressure of the atmosphere, instead of applying the elastic power of the steam for original motion; the power of which I supposed irresistible. I renewed my studies with increased ardour, and soon declared that I could make steam wagons, and endeavoured to communicate my ideas to others; but however practicable the thing appeared to me, my object only excited the ridicule of those to whom it was made known. But I persevered in my belief and confirmed it by experiments that satisfied me of its reality. In the year 1786 I petitioned the legislature of Pennsylvania for the exclusive right to use my improvements in flour mills, as also steam wagons in that state. The committee to whom the petition was referred heard me very patiently, while I described the mill improvements, but my representations concerning steam wagons made them think me insane. They however, reported favourably respecting my improvements in the manufacture of flour, and passed an act granting me the exclusive use of them, as prayed for. This act is dated March 1787. But no notice is taken of the steam wagons. A similar petition was also presented to the legislature of Maryland. Mr. Jesse Hollingsworth, from Baltimore, was one of the committee appointed to hear me and report on the case. I candidly informed this committee of the fate of my application to the legislature of Pennsylvania respecting the steam wagons; declaring, at the same time, without the encouragement prayed for, I would never attempt to make them; but that, if they would secure to me the right as requested, I would, as soon as I could, apply the principle to practice; and I explained to them the great elastic power of steam, as well as my mode of applying it to propel wagons. Mr. Hollingsworth very prudently observed, that the grant could injure no one, for he did not think that any man in the world had thought of such a thing before; he therefore wished the encouragement might be afforded, as there was a prospect that it would produce something useful. This kind of argument had the desired effect, and a favourable report was made May 21, 1787, granting to me, my heirs and assigns, for fourteen years, the exclusive right to make and use my improvements in flour mills and the steam wagons in that state. From that period I have felt myself bound in honour to the state of Maryland to produce a steam wagon as soon as I could conveniently do it. In the year 1789, I paid a visit to Benjamin Charles and sons, clock makers; men celebrated for their ingenuity, with a view to induce them to join me in the expense and profits of the project. I showed to them my drafts, with the plan of the engine, and explained the expansive power of steam; all which they appeared to understand, but fearful of the expense and difficulties attending it, declined the concern. However, they certified that I had shown to them the drawings and explained the powers, &c. In the same year, I went to Ellicott's mills on the Patapsco, near Baltimore, for the purpose of persuading Messrs. Jonathan Ellicott and brothers, and connections, (who were equally famous for their ingenuity), to join me in the expense and profits of making and using steam wagons. I also showed to them my drawings, and minutely explained to them the powers of steam. They appeared fully to compre-

hend all I said, and in return informed me of some experiments they themselves had made, one of which they showed me. They placed a gun-barrel having a hollow arm, with a small hole on one side at the end of the arm, similar to Barker's rotary tube mill, as described in the books; a gill of water put into this barrel, with fire applied to the breech, caused the steam to issue from the end of the arm with such force, as by reaction, to cause the machine to revolve, as I judged, about one thousand times in a minute, for the space of about five minutes; and with considerable force for so small a machine. I tarried here two days, (May 10 and 11, 1789), using my best efforts to convince them of the possibility and practicability of propelling wagons on good turnpike roads, by the great elastic power of steam. But they also feared the expense and difficulty of the execution, and declined the proposition; yet they heartily esteemed my improvements in the manufacture of flour, and adopted them in their mills, as well as recommended them to others.

In the same year I communicated my project, and explained my principles, to Levi Hollingsworth, Esq., now a merchant in Baltimore. [I certify that Oliver Evans did about the year 1789, communicate a project to me, of propelling land carriages by power of steam, and did solicit me to join him in the costs and profits of the same. Levi Hollingsworth, Baltimore, Nov. 16th, 1812. I do certify, that some time about the year 1781, 31 years ago, Oliver Evans, in conversation with me, declared, that by the power of steam he could drive any thing; wagons, mills, or vessels, forward, by the same power, &c. Enoch Anderson, Nov. 15th, 1812.] He appeared to understand them; but also declined a partnership in the scheme for the same reasons as the former. From the time of my discovering the principles and the means of applying them, I often endeavoured to communicate them to those I believed might be interested in their application to wagons or boats. But very few could understand my explanations, and I could find no one willing to risk the expense of the experiment. In the year 1785 or 86, before I had petitioned the legislatures, I fell in company with Samuel Jackson, of Redstone; and learning of him that he resided on the western waters, I endeavoured to impress upon his mind the great utility and high importance of steam boats, to be propelled on them; telling him that I had discovered a steam engine so powerful according to its weight, that it would, by means of paddle-wheels (which I described to him) readily drive a vessel against the current of those waters with so great speed as to be highly beneficial. Mr. Jackson proves that he understood me well, for he has lately written letters declaring that about twenty-six years before their date, I did describe to him the principles of the steam engine that I have since put into operation to drive mills, which he has seen—and that I also explained to him my plan for propelling boats by my steam engine with *paddle wheels*; describing the very kind of wheels now used for this purpose; and that I then declared to him my intention to apply my engine to this particular object as soon as my pecuniary circumstances would permit. In the year 1800, or 1801, never having found a man willing to contribute to the expense, or even to encourage me to risk it myself, it occurred to me that though I was then in full health, I might be suddenly carried off by the yellow fever, that had so often visited Philadelphia; or by some other disease or casualty to which all are liable, and that I had not yet discharged my debt of honour to the

state of Maryland by producing the steam wagon. I determined therefore to set to work the next day and construct one. I first waited upon Robert Patterson, Esq., professor of mathematics in the University of Pennsylvania, and explained to him my principles—as I also did to Charles Taylor, steam engineer from England. They both declared these principles to be new to them, and highly worthy of a fair experiment, advising me without delay to prove them; in hopes I might produce a more simple, cheap, and powerful steam engine, than any in use. These gentleman were the only persons who had such confidence, or afforded me such advice. I also communicated my plans to B. F. Latrobe, Esq., at the same time; who publicly pronounced them chimerical, and attempted to demonstrate the absurdity of my principles, in his report to the Philosophical Society of Pennsylvania, on steam engines; in which same report, he also attempts to show the impossibility of making steam boats useful, on account of the weight of the engine; and I was one of the persons alluded to, as being seized with the steam mania, conceiving that wagons and boats could be propelled by steam engines. The liberality of the members of the society caused them to reject that part of the report which he designed as demonstrative of the absurdity of my principles; saying they had no right to set up their opinions as a stumbling-block in the road of any exertions to make a discovery. They said I might produce something useful, and ordered it to be stricken out. What a pity they did not also reject his demonstrations respecting steam boats! for notwithstanding them, they have run, are now running, and will run: so has my engine, and all its principles, completely succeeded: and so will land carriages, as soon as these principles are applied to them, as explained to the legislature of Maryland in 1787, and to others long before. In consequence of the determination above alluded to, I hired hands, and went to work to make a steam wagon, and had made considerable progress in the undertaking, when the thought struck me, that as my steam engine was entirely different in form as well as in its principles from all others in use, that I could get a patent for it, and apply it to mills more profitably than to wagons; for until now I apprehended, that as steam mills had been used in England, I could only obtain a patent for wagons and boats. I stopped the work immediately, and discharged my hands, until I could arrange my engine for mills, laying aside the steam wagon for a time of more leisure. Two weeks afterwards, I commenced the construction of a small engine for a mill to grind plaster of Paris; the cylinder six inches in diameter, and stroke of the piston eighteen inches; believing that with $1000 I could fully try the experiment. But before I was done with experiments, I found that I had expended $3,700 —all that I could command. I had now to begin the world anew at the age of forty-eight, with a large family to support. I had calculated that if I failed in my experiment, the credit I had would be entirely lost; and without money or credit, at my advanced age, with many heavy encumbrances, my way through life appeared dark and gloomy indeed. But I succeeded perfectly with my little engine, and preserved my credit; I could break and grind 300 bushels of plaster of Paris, or 12 tons, in twenty-four hours; and to show its operations more fully to the public, I applied it to saw stone on the side of Market street, where the driving of twelve saws, in heavy frames, sawing at the rate of 100 feet of marble stone in twelve hours, made a great show, and excited much attention. I thought this was sufficient to convince

the thousands of spectators of the utility of my discovery: but I frequently heard them enquire if the power could be applied to saw timber as well as stone, to grind grain, propel boats, &c.; and though I answered in the affirmative, I found they still doubted. I therefore determined to apply my engines to all new uses, to introduce it and them to the public. This experiment completely tested the correctness of my principles, according to my most sanguine hopes. The power of my engine rises in a geometrical proportion, while the consumption of fuel has only an arithmetical ratio; in such proportion that every time I added one fourth more to the consumption of fuel, the powers of the engine were doubled; and that twice the quantity of fuel required to drive one saw would drive sixteen saws at least; for when I drove two saws the consumption was eight bushels of coals in twelve hours, but when twelve saws were driven, the consumption was not more than ten bushels; so that the more we resist the steam the greater is the effect of the engine. On these principles, very light, but powerful engines, can be made, suitable for propelling boats and land-carriages, without the great incumbrance of their own weight, as mentioned in Latrobe's demonstrations.

In the year 1804, I constructed at my works, situate a mile and a half from the water, by order of the board of health of the city of Philadelphia, a machine for cleansing docks. It consisted of a large flat or scow, with a steam engine of the power of five horses on board, to work machinery to raise the mud into flats. This was a fine opportunity to show the public that my engine could propel both land and water carriages, and I resolved to do it. When the work was finished, I put wheels under it, and though it was equal in weight to two hundred barrels of flour, and the wheels fixed with wooden axle-trees, for this temporary purpose in a very rough manner, and with great friction of course, yet with this small engine I transported my great burthen to the Schuylkill with ease; and when it was launched in the water, I fixed a paddle wheel at the stern, and drove it down the Schuylkill to the Delaware, and up the Delaware to the city, leaving all the vessels going up, behind me, at least half way, the wind being ahead. Some wise men undertook to ridicule my experiment of propelling this great weight on land, because the motion was too slow to be useful. I silenced them by answering, that I would make a carriage, to be propelled by steam, for a bet of $3000, to run upon a level road against the swiftest horse they would produce. I was then as confident as I am now, that such velocity could be given to carriages. Having no doubt of the great utility of steam carriages on good turnpike roads, with proper arrangements for supplying them with water and fuel, and believing that all turnpike companies were deeply interested in putting them into operation, because they would smooth and mend the roads, instead of injuring them as the narrow wheels do. On the 25th September, 1804, I submitted to the consideration of the Lancaster turnpike company, a statement of the costs and profits of a steam carriage to carry one hundred barrels of flour, fifty miles in twenty-four hours—tending to show that one such steam carriage would make more net profits than ten wagons drawn by five horses each, on a good turnpike road, and offering to build such a carriage at a very low price. My address closed as follows:—"It is too much for an individual to put in operation every improvement which he may invent. I have no doubt but that my engines will propel

boats against the current of the Mississippi, and wagons on turnpike roads, with great profit. I now call upon those whose interest it is to carry this invention into effect. All which is respectfully submitted for your consideration."

In the year 1805, I published a book describing the principles of my steam engine, with directions for working it, when applied to propel boats against the current of the Mississippi, and carriages on turnpike roads. And I am still willing to make a steam carriage that will run fifteen miles an hour, on level railways, on condition that I have double price if it shall run with that velocity; and nothing for it if it shall not come up to that velocity. What can an inventor do more than to insure the performance of his inventions? Or, I will make the engine and apparatus at a fair price, and warrant its utility for the purpose of conveying heavy burthens on good turnpike roads. I feel it just to declare that, with Mr. Latrobe, I myself did believe that the ponderous and feeble steam engine, now used in boats, could never be made useful in competition with sail boats, or to ascend the Mississippi, esteeming the current more powerful than it is. But I rejoice that, with him, I have been mistaken; for I have lived to see boats succeed well with those engines, so as to induce the proprietors to exchange the old for the new, more cheap and more powerful, principles. I have been highly delighted in reading a correspondence between John Stephens, Esq. and the commissioners appointed by the legislature of New York, for fixing on the scite of the great canal proposed to be cut in that state. Mr. Stephens has taken a most comprehensive and very ingenious view of this important subject, and his plan of railways for the carriages to run upon removes all the difficulties that remained. I have had the pleasure, also, of hearing gentlemen of the keenest penetration, and of great mechanical and philosophical talents, freely give in to the belief that steam carriages will become very useful. John Ellicott proposed to make roads of substances such as the best turnpikes are made with, with a path for each wheel to run on, having a railway on posts in the middle, to guide the tongue of the wagon, and to prevent any other carriage from traveling on it. Then, if the wheels were made broad and the paths smooth, there would be very little wear. Such roads might be cheaply made; they would last a long time and require very little repair. Such roads, I am inclined to believe, ought to be preferred, in the first instance, to those proposed by Mr. Stephens, as two ways could be made in some parts of the country for the same expense as one would be with wood; but either of the modes would answer the purpose, and the carriages might travel by night as well as in the day. When we reflect upon the obstinate opposition that has been made by a great majority to every step towards improvement: from bad roads to turnpikes, from turnpikes to canals, from canals to railways for horse carriages, it is too much to expect the monstrous leap from bad roads to railways for steam carriages. But why may not the present generation, who have already good turnpikes, make the experiment of using steam carriages upon them? They will assuredly effect the movement of heavy burthens, with a slow motion of two and a half miles an hour, and as their progress need not be interrupted, they may travel fifty or sixty miles in the twenty-four hours. This is all that I hope to see in my time, and though I never expect to be concerned in any business requiring the regular transportation of heavy burthens on land, because if I am connected

in the affairs of a mill it shall be driven by steam and placed on some navigable water, to save land carriage, yet I certainly intend, as soon as I can make it convenient, to build a steam carriage that will run on good turnpike roads, on my own account, if no other person will engage in it; and I do verily believe that the time will come when carriages propelled by steam will be in general use, as well for the transportation of passengers as goods, traveling at the rate of fifteen miles an hour, or three hundred miles per day. It appears necessary to give the reader some idea of the principles of the steam engine, which is to produce such novel and strange effects; and this I will endeavour to do in as few words as I can, by showing the extent to which the principles are applied already. To make steam as irresistible or powerful as gunpowder, we have only to confine and increase the heat by fuel to the boiler. A steam engine with a working cylinder only nine inches in diameter, and a stroke of the piston three feet, will exert a power sufficient to lift from 3,000 to 10,000 pounds perpendicularly, two and a half miles per hour. This power applied to propel a carriage on level roads or railways would drive a very great weight with much velocity, before the friction of the axle-tree or resistance of the atmosphere would balance it. This is not speculative theory, the principles are now in practice; driving a saw-mill at Manchacks on the Mississippi, two at Natchez, one of which is capable of sawing 5000 feet of boards in 12 hours; a mill at Pittsburgh able to grind twenty bushels of grain per hour; one at Marietta of equal powers; one at Lexington of the same powers; one, a paper mill, of the same; one of one fourth the power at Pittsburgh; one at the same place of three and a half times the power for the forge, and for rolling and splitting sheet iron; one of the power of twenty-four horses, at Middletown, Conn. driving the machinery of a cloth manufactory: two at Philadelphia of the power of five or six horses, and many making for different purposes; the principles applying to all purposes where power is wanted.

OLIVER EVANS.

Ellicott's Mills on the Patapsco, Nov. 12, 1812.

To the Honourable the Secretary of State, the Secretary of War, and the Attorney General; the petition of John Fitch, of the city of Philadelphia, humbly showeth:

That your petitioner, in the spring of the year 1785, conceived the idea of applying steam to the purpose of propelling vessels through the water: that, fully satisfied, in his own mind, of the practicability of such a scheme, of its great immediate utility, and the important advantages which would in future result therefrom, not only to America, but the world at large, if the scheme should be carried into effectual operation, he divested himself of every other occupation, and undertook the arduous task, not doubting, that when perfected he should be amply rewarded. In his first attempts to procure assistance from congress, and the legislatures of many of the states, from the peculiar situation of her finances, and the seeming impossibility of the success of his scheme, he met with no relief. Not entirely discouraged by these disappointments, he continued his application to his project, and prayed several of the states for an exclusive 'right to the use of fire and steam to navigation': that New Jersey, New York, Pennsylvania, Delaware, and Virginia granted him

an exclusive right, agreeably to the prayer of his petition, for fourteen years. —That the impracticability of procuring experienced workmen in America, your petitioner's total ignorance of the construction of a steam engine, together with the necessary deviations from the form described in books, in order to accommodate its weight and bulk to the narrow limits of a vessel, have caused him not only to expend about eight thousand dollars in successive experiments, but nearly four years of some of his grants have expired, before he has been able to bring his engine to such a degree of perfection as to be carried into use.

That having, at length, fully succeeded in his scheme, proofs of which he is prepared to offer, he trusts he now comes forward, not as an imaginary projector, but as a man who, contrary to the popular expectation, has really accomplished a design which, on examination, will clearly evince the many and important advantages which must result therefrom to the United States, some of which your petitioner begs leave to enumerate.

The western waters of the United States, which have hitherto been navigated with difficulty and expense, may now be ascended with safety, conveniency and great velocity; consequently, by these means, an immediate increased value will be given to the western territory: all the internal waters of the United States will be rendered much more convenient and safe, and the carriage on them much more expeditious; that from these advantages will result a great saving in the labour of men and horses, as well as expense to the traveller.

Your petitioner also conceives, that the introduction of a complete steam engine, formed upon the newest and best principles, into such a country as America, where labour is high, would entitle him to a public countenance and encouragement, independent of its use in navigation; he begs leave to say that the great length of time, and vast sums of money, expended in bringing the scheme to perfection have been wholly occasioned by his total ignorance of the improved state of steam engines, a perfect knowledge of which has not been acquired, without an infinite number of fruitless experiments; for not a person could be found who was acquainted with the minutia of Bolton and Watt's new engine; and whether your petitioner's engine is similar or not to those in England, he is to this moment totally ignorant; but is happy to say, that he is now able to make a complete steam engine, which in its effects, he believes, is equal to the best in Europe; the construction of which he has never kept a secret.

That on his first undertaking the scheme, he knew there were a great number of ways of applying the power of steam to the propelling of vessels through the water, perhaps all equally effective; but this formed no part of his consideration, knowing, that if he could bring his steam engine to work in a boat, he would be under no difficulty in applying its force; therefore he trusts no interference with him in propelling boats by steam, under any pretence of a different mode of application, will be permitted; for should that be the case, the employment of his time, and the amazing expense attending the perfecting his scheme, would, whilst they gave the world a valuable discovery, and to America peculiar and important advantages, eventuate in the total ruin of your petitioner; for a thousand different modes may be applied by subsequent navigators, all of them benefiting by the expense and persevering labour of your petitioner, and thus sharing with him those profits, which they

never earned; such a consequence he is confident will not be permitted by your honourable body.

Your petitioner therefore prays that your honours will take the subject of his petition into consideration, and by granting him an exclusive right to the use of steam navigation, for a limited time, do him that justice which he conceives he merits, and which he trusts will redound to the honour and add to the true interest of America: and your petitioner, as in duty bound, shall ever pray. JOHN FITCH.

New York, 22*d June*, 1790.

CERTIFICATE.

District of Columbia, Washington county,

At the request of Dr. William Thornton, of this county, personally appeared before me, the subscriber, one of the justices of the peace for the said county, Oliver Evans of Philadelphia, who solemnly affirmed, that when John Fitch and his company were engaged in constructing their steamboat in Philadelphia, he, the said Oliver, suggested to the said John Fitch the plan of driving and propelling the said boat by paddle or flutter wheels at the sides of the boat; when the said Fitch or some other person, but he thinks it was Fitch, informed him that one of the company had already proposed and urged the use of wheels at the sides, but that he had objected to them. The said Oliver also states that he afterwards mentioned the same to Henry Voight, one of the members of that company, who said that Dr. William Thornton, also a member of the same, was the person who had proposed the said paddle or flutter wheels at the sides of the boat, but that both himself and John Fitch had objected to them.

The said Oliver further saith, that Robert Fulton, the patentee of steam boats in the state of New York, had observed to him, that he deemed it impossible to drive a boat or vessel, by steam, at a greater speed than five miles per hour: but the said Oliver says, he had understood Fitch's boat had far exceeded that speed, and that Fitch's experiment had completely succeeded to show that boats could be driven by steam to advantage; and also that when the said John Fitch was afterwards setting out for the western country, he called on the said Oliver at his house, and declared his intention to be to form a company, to establish steamboats on the western waters; of the advantages of which he appeared to have formed vast conceptions and great expectations. The said Oliver also saith, that some time about the years 1786, 1787, or 1788, the said Fitch informed him that he contemplated employing his steamboat on the lakes, and meant to construct them with two keels, to answer as runners, and when the lakes should freeze over he would raise his boat on the ice, and by a wheel on each side, with spikes in the rims, to take hold of the ice, he calculated it would be possible to run thirty miles an hour. And also that he meant to tow boats and other floats by steamboats.

(Signed) OLIVER EVANS.

Affirmed to before the subscriber, one of the justices of the peace for Washington county, Columbia, this 16th day of December, 1814.

JOSEPH FORREST.

On the Origin of the Woollen Trade in England, &c.

Wool has been considered at all times as a valuable commodity; we find the use of wool in the earliest periods, and flocks of sheep are mentioned in the first ages of mankind; kings have not been ashamed to employ themselves in the care of them. The patriarch Abraham had flocks, and the Israelites of that early time employed themselves in the care of them; their neighbours, the Midianites, had such numbers, that the Israelites took among the spoil more than six hundred thousand; and two hundred and fifty thousand were taken from the Hagarites by the sons of Reuben. The Ethiopians had sheep; for when Asa conquered a part of their country, he carried them away in abundance. The Arabians at the same period had also sheep, for they brought more than seven thousand rams at one time to Jehoshaphat; and the Moabites must have bred them in great quantity, for Mesha, king of that country, rendered to the king of Israel a hundred thousand lambs, and a hundred thousand rams. These are passages of history delivered in the Old Testament; and by these we find that at this remote time the Israelites had sheep in great abundance, and that the Midianites and Hagarites, the Ethopians and the Arabians, and the Moabites, fed them also in vast numbers. There is an account of sheep bred, in a manner, all over the eastern quarter of the world; and we have occasional mention of the same creature making a chief object of the care, and a principal article in the rites, of the Amalekites, the Philistines, and the people of Damascus. We see a great part of the quarter of the world then most inhabited, devoted to the care of this useful animal. This creature was not bred only for its flesh; the mention of wool is made in some of these passages, and in others there are allusions to the implements of weaving, and of the method of preparing wool for the loom. That the Israelites fed sheep for the wool, may be seen by the tithe exacted on it. The first of the fleece is declared the due of the priest: and that other countries knew its value in the same manner is plain, from an instance in the present of the Moabitish king, before named, which is, that the rams were given with their wool. The staff of Goliah's spear is said to equal a weaver's beam. The fuller's field is mentioned in Isaiah, and by the prophet Malachi; and Ezekiel calls the people of Damascus, "merchants in white wool." These passages are the summary of what is said concerning flocks of sheep, their wool and its manufacture, in the scriptures; and they show that the shearing of sheep, the use of wool, the manufacturing into cloth, and the preparing that cloth by fulling, were articles known in the earliest time. It establishes the care of this animal, and the use of its fleece, upon a very great authority of ancient history; it produces examples that may animate all persons to interest themselves in the care and management of its fleece, and legislative powers to establish and encourage the manufacture of it. This attention of individuals and of public authority, is greatly wanting at present in America, for the advancement of our woollen manufactures; let those who sit in high places remember the "*wool-sack.*" All old historians mention the care of flocks, and value of their wool: the Greeks used it for the purposes of clothing, and they refer to times much earlier than their own, as familiar in the same use; the Tyrian purple was employed in dyeing woollen cloth, and the early expedition of the Argonauts to Colchis for what was called the golden fleece, was no more than a voyage in search of this commodity. Naturalists

may suppose their voyage was in search of gold, and the adepts pretend the secret of the philosopher's stone was couched under this mystery ; but plain reason and the most authentic accounts of this transaction say nothing more than this: that the people of Colchis understood the management of sheep, and the manufacturing of their wool, better than any other nation of that time, and that Jason and his partners in that expedition, after encountering many dangers at sea, brought back a quantity of the wool, and a number of the natives to manage the same article in their country. The city of Corinth became afterwards a general mart for wool; and after Pompey had dispersed the pirates, the same article was a very considerable branch of the commerce carried along the coasts of the Mediterranean. Spain is mentioned with great commendation for the wool it produced in those times, and the manufactures made from it; some attribute the invention of weaving woollen cloth to the people of that nation. Wool was received in early times from many parts of the Euxine; and the trade of the Baltic was, in a great measure, supported by it. The Armenians obtained wool and woollen cloths of the Turks, in exchange for horses; and Rome, in somewhat later times, received woollen manufactures from Alexandria. This all stands established on the best authorities, and is related by all the authors who have had occasion to mention the commerce of those ages. In the East they less regard the produce of wool now, because their principal manufactures are in silk and cottons, but there is a great deal of very fine wool in Asia, Syria, and Persia. They have a particular breed of sheep, whose wool is long and grayish, and they make certain peculiar manufactures of it, and those much esteemed. In China and the East Indies the produce of wool is so great, that they shear their sheep three times a year. One of the earliest notices we have of sheep in Britain, with respect to their value, is found in Stillingfleet, who tell us, that between 712 and 727, were made certain laws of King Ina, and in those a price was set upon sheep. The price of an ewe and her lamb together, till a fortnight after Easter, is set down at one shilling. The value of money was then very different from what it is now, but this, with all the allowance that can be made on that head, is but a very poor price. Alfred, famous for the care of arts and commerce, took no small pains to improve this manufacture, but it did not much succeed. In the year 885, he set about this great work, but wolves were too numerous in the island to let sheep be kept in safety. The consequence of the encouragement Alfred gave to the raising of sheep was seen in the succeeding years; for in 918, Edward, who had married the daughter of a country gentleman, distinguished by the regard he had shown to this great concern, and thence called by those who little understood what they read in earlier writers, a shepherd, had his own daughters instructed in the art of carding, spinning, and manufacturing wool. This double patronage bestowed by Edward, the countenance he gave to one who employed himself in breeding sheep, and to the example he set in making his daughters work the wool, was of so much assistance to the manufacture, that the pasturage of the southern countries became soon occupied in feeding sheep, and every one fond of recommending himself to the royal favour became a shepherd, or at least employed his attention greatly on that article. The value of the sheep rose in proportion to the number, for with the increase in quantity of wool the numbers of manufacturers increased, and the demand for it enlarged. Richard I. in

the year 1173, returning from the holy war, was taken prisoner by the Duke of Austria. A vast ransom was required, and toward raising it one year's wool was demanded from two abbeys. This is a passage recorded by Rapin, and is supported on the best authorities; and this shows, though we have not had any regular account, that all the time the price of sheep was increasing, the value of wool was also rising, and that this was the principal cause of their increase of value. When quantities of wool began to be exported, the manufacturing of it at home increased; about thirty years after England found the way of serving her neighbours with wool, they improved in the art of dyeing. At first, wool was only wrought up in a coarse plain way, for the clothing of the farmer and his family; by degrees those who best understood the working it up, brought what they had to spare to market. But all this time the wool was only wrought up as it was furnished by the sheep, and all cloth was of the same colour; when the legislature encouraged its manufacture it continued to prosper.

We find by those accounts how little historians and others have considered this important work. Those who speak of the manufacture of broad cloths in England, follow one another in placing the time of their being first made at the year 1331. But we find they were made in 1220.

In 1284, foreign merchants were permitted to establish themselves in the kingdom, for the encouragement of the woollen manufactures. They had, till that time, only been allowed to board, and could not trade otherwise than by making their landlords their brokers; but now they were permitted to traffic in their own names; and the privilege granted to them was of the utmost benefit to the trade. So vastly did the trade increase and the manufacture flourish, that a few years after we find the traffic very flourishing in London, and several of the sea-port towns. From this period the woollen trade became an object, more than ever, of the public concern. Persons of all nations who could improve the manufacture of broad cloth, were encouraged to come over: and among numbers, brought under great encouragements from Flanders, Brabant, and Zealand, there were some so worthy of the advantages they received, that they soon set the trade upon a most respectable footing abroad, and upon the most profitable foundation at home. In consequence of the greater traffic in this article, the price rose; and more assistances were drawn from it for the state: in the reign of Edward III. we read of subsidy after subsidy, on wool: and in the reign of Richard II. more subsidies were demanded; the trades complained, and the matter being candidly examined, it appeared that though they were not without reason of complaint, the trade could bear more loads, and still make fortunes. In the reign of Richard III., though the traffic was encumbered with large subsidies, it increased continually. In the reign of Henry VII. the greatest regard was shown to trade in every article, and in none more than this: the exportation of wool was limited, and the manufacture of cloths increased accordingly. In the reign of Henry VIII. the produce of wool was greater than at any time before; and its price increased with the quantity; farmers were laid under limitations, as to the number of sheep they were to keep; but these were very extensive, and we may see by the account preserved of this transaction, and of the price of things at that time, to what an advance the care of that animal, and the price of its flesh and wool, had arisen.

Husbandry had been, in early times, little understood in England; but the regard to wool, the demand for which was so considerable, and the price so large, gave a spirit to the people, which has continued to the present time. The care of the pasturage grew with the number of enclosures, and the thriving of sheep and the price of wool rose with it. It sold, in this reign, dearer than in any of the preceding. Statutes were made, from time to time, to encourage the manufacture of cloths, and marts were established in different places. In the reign of Philip and Mary, the subsidies granted to Edward VI. were continued: many good statutes were enacted in favour of the woollen manufacture, in this reign; and it throve greatly under the prudent regulations which were established, and extended itself to many parts of the kingdom. In Queen Elizabeth's time a subsidy was granted for life, included in tonnage and poundage: many good statutes were made, and numbers of the French and Flemish, leaving their native country because of persecution, brought over their secrets, and increased our credit. In this reign, wool rose from its former price. We may establish the period from the end of the reign of Edward VI. to the end of Queen Elizabeth's, as the most flourishing of all times for the wool trade of England up to the last century.

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*The Worsted or Long Wool Manufacture.**

The reason why a long stapled, strong, and firm, though somewhat coarse wool, is best adapted for worsted stuffs, is because they require a fine smooth yarn, which shall have little or no tendency to shrink, curl, and felt, when made into cloth. Hence the fibres must not be entangled and crossed by carding, but on the contrary, be disposed as nearly as possible in parallel lines, by a peculiar combing operation. The yarn thereby producible will be comparatively level, slender, and hard, fit for warping and wefting into finer and more compact goods. The first process to which the long wool is subjected, in a worsted factory, is washing, which is performed exclusively by men, with soap and water. They are paid by quantity, each man being attended by a boy, who receives the wool as it issues from between the two rollers in front of the washer, which squeeze out the greatest part of the moisture. The wool is then carried by the boy, in large baskets, to the drying room, where it is spread upon the floor. The drying-room is generally placed over the boilers of the steam engine, and is thus kept at a high temperature. After drying, the wool is removed to a machine called the plucker, which is always attended by a boy. His business is to lay the tufts of wool even, in an endless web, on an apron, which, as it travels forward, delivers the wool to a pair of spiked rollers, by which it is carried to the interior apparatus, which is somewhat similar to the willow employed in the cotton factories, and thence it is blown out at the opposite side. The use of this mechanism is to clean and straighten the fibres of the wool, and to prepare it for the next machine, the comb-card. In the old routine of the trade, and

* Worsted is a thread spun of wool that has been combed, and which, in the spinning, is twisted harder than ordinarily. It was chiefly used formerly, either to be woven into stockings, caps, gloves, &c. Worsted has obtained its name from Worstead, a market town in the county of Norfolk, England; where the manufacture of the article was first introduced.

still for the finest description of work, the wool is not carded in the factory, but is given out to the wool combers, who comb it by hand.

Three implements are in common use for combing long wool:—1, a pair of combs for each workman: 2, a post to which either of the combs can be fixed: and 3. a comb-pot or small stove, for heating the teeth of the combs. Each comb is composed of two rows of tapering pointed steel teeth, disposed in two parallel planes; of which one row is longer than the other. They are fixed into a wooden stock or head which is covered with horn, and has a handle fixed into it, perpendicular to the planes of the teeth-range. The space between these planes is only one-third of an inch at the bottom of the teeth. The combs used for the last combing have three rows of teeth, In the work shop a post is fixed, in order to support the combs occasionally during the process. An iron stem is fixed into it, which has an upturned point, for passing through a hole of the handle of the comb, while it has a staple pin at its inner end, for entering into the hollow extremity of the handle, and by the two fixtures holding it fast to the post. The stove consists of a flat iron plate, heated by a fire, or by steam, and surmounted by another plate for confining the heat. Into a small space left between the two plates, the teeth of the combs are introduced.

In combing the wool, the workman separates it into handfuls of about four ounces each, sprinkles it with oil, and rolls up in his hands, to smear it uniformly. The proportion of oil varies from a fortieth to a sixteenth of the weight in wool. Having fastened a heated comb to the post with its teeth upwards, the workman takes one half of that quantity of wool in his hand, and, throwing it over the points of the comb, draws it through them, and so repeatedly, a portion of wool remaining each time in the comb. When all the wool is gathered on the teeth, the comb is placed with its points in the stove, and the wool hanging on the outside receives a portion of the heat. The other comb, now hot, is fixed to the post, and filled in its turn, with the other half of the four ounces of wool, and is then removed to the stove, like the first. When both combs are properly warmed, the comber holds one of them, with his left hand over his knee, as he is seated on a low stool, and with the other comb, held in his right hand, he combs the wool upon the first, by introducing the points of the teeth of one comb into the wool contained in the other, and drawing them through it. This is repeated till the fibres are laid parallel. He always begins by introducing the points of the teeth of one comb first into the extremity of the fleece contained in the teeth of the other comb, and he then advances deeper at each succeeding stroke, till, eventually, he works the combs as closely together as possible without bringing their teeth into collision; otherwise, he could not draw the comb through the wool without breaking its fibres, or tearing the wool out of the teeth of the comb. The short wool which remains on the teeth of the comb at last, because it does not reach the place where the comber grasps it, is called *noyl*, and is unfit for worsted spinning; it amounts to about an eighth of the new wool by weight.

The wool which is drawn off from the comb forms a continuous sliver or band, with straight parallel fibres, but is still not ready for the spinning machine, till combed again at a somewhat lower temperature. When the process is complete, the wool is formed into parcels containing ten or eleven slivers each.

A great many self-acting machines have been contrived for performing the wool-combing operations. One was made the subject of a patent by John Platt, of Salford, 1827, being an invention communicated to him by a foreigner. This machine is intended to comb wool by means of two revolving combs or heckles. It consists of a square frame of iron mounted upon legs, and two axles, upon each of which one of the circular combs is mounted. These axles are not placed in horizontal positions, but are inclined at acute angles to the horizon, and in directions crossing each other. These combs are made in the form of ordinary wheels, with arms, of which the nave is attached to the axle by screws. The points or teeth are set in the edge of the rim, at right angles to the axis of the wheel, and are made to revolve in opposite directions by means of a crossed or twisted strap, running over a pulley on each axle; these being driven by a band and rigger, or power pulley, on the end of the axle. As the comb wheels go round they are made to approach each other slowly. This approach is caused by mounting the bearings of the axle in slots, which allow of their sliding, and enable that axle and its circular comb to be brought towards the circular comb on the axle. This traverse movement is effected by an endless screw and toothed wheel, or snail work, connected to the under part of the frame. This mechanism gradually moves the axle in a lateral direction, while the twisted strap which connects the two axles, and drives, by rotation, is kept at its proper tension, as the circular combs approach each other by means of a heavy roller, which hangs on a jointed lever. In putting this comb in operation, the proper quantity of wool, in its entangled state, is to be stuck between the teeth, and when the wheels are set in rapid rotary motion, the loose ends of the fleece will, by the centrifugal force, be thrown out in the direction of radii, and will catch against the points of the teeth of the other revolving comb, whereby the fibres will be drawn out and straightened. The operation is to commence when the comb-wheels are at their greatest distance apart. As they slowly approach each other, the ends or fibres of the wool will be laid hold of by the teeth-points, at progressively increasing depths, until the wheels come near together; by which time the whole length of the staple will have been combed out smooth, and will be then drawn from the comb, by throwing the driving-belt, as usual, on a loose pulley. The *noyls*, or short refuse wool, which remains entangled among the teeth being removed, the machine is charged for another operation.

In one of these large machines, the comb-wheels are ten feet in diameter, and are furnished with hollow iron spokes filled with steam, which keep the whole apparatus at a proper combing heat. These wheels are made to revolve slowly, while a boy, seated on the ground, dresses one of them with wool; they are then made to revolve with great rapidity, by shifting the driving-belt on the proper pulley, during which revolution they gradually approach each other. Such machines will supersede the hand comb.

The *breaking frame* is the next machine in the worsted manufacture, and is, in fact, a continuous form of comb or card, called by the French the *défeutreur*, from its opening out any felted fibres. It represents a vertical section of a breaking comb, for the purpose of explaining the principles of its action. A frame for carrying the machines, of which there are usually four alongside of one another, each from four to six inches broad. The front or feeding pair of rollers, three inches in diameter, the upper one bearing by a

weight suspended to its axis on the under; the continuous lower comb, and the upper comb going with the same velocity as the lower. (See Dr. Ure *on Worsted.*) The rows of teeth slope gently forwards, and alternate with the teeth of the other comb; thus the row of the one corresponds to the middle of the two other rows. Fluted cylinders, which cause the rotation of the endless chain of combs. Counter cylinders, fluted in like manner. The forked bearings in which these turn are so mounted as to permit the comb-chain to be stretched. Small tension-cylinders, for giving a proper direction to each comb. The second pair of rollers, which takes the wool from the combs. These rollers are like the first, made of wood, and of the same diameter. The under one of this pair is kept clean by a brush. On its axis the fast and loose power pulleys are fixed, which give motion to the whole machine. The upper roller is furnished with wiper-wings; that is, its surface is covered with a series of small leaves of parchment, held by one of their edges with little clamps, or keys, in grooves cut lengthwise on their surface. The same cylinder is firmly pressed down on the lower one by a loaded steelyard.

The speed of the first pair of rollers is to that of the second as one to four, and the velocity of the comb-train is the geometrical mean between them, or two. Too great a velocity in these parts would be apt to knot and felt the wool; and it must not therefore exceed above five or six inches in a second. A copper funnel, or trumpet mouth, for conducting the sliver delivered by the second rollers. The third pair of rollers turning with a little more velocity than the second pair, only in consequence of having a diameter a little greater.

The comb of this continuous machine is formed of a series of small rectangular pieces of tin-plate, hinged together, the half of one overlapping that of the other, like slates on a roof. These pieces are struck out by a punch, which leaves at their four corners little discs which are afterwards bent back to a right angle by a pair of plyers, and which serve to make the hinge joints. (*Philosophy of Manufactures.*) While the chain is advancing in a straight line, the teeth soldered to the lower tin-plate present the whole of their projection, minus the thickness of the upper plate, which is here cleft; but in proportion as these plates come upon the fluted cylinders which drive them, the plates cease to lie flat on each other, and become inclined by the curvature of the cylinders. The part cut through for the passage of the teeth recedes, or turns out of the way, and thereby passes by the extremities of the teeth; thus getting disengaged from the fibres of the wool, and allowing them to be immediately seized by the second pair of rollers. In this way each piece of tin plate acts both as a tooth and a disengaging bar. It is obvious that the upper and the lower combs, during their parallel progress, by means of their alternate rows of teeth passing between each other, like the fingers of our two hands, perform a double combing at a single stroke upon the cardings introduced in pairs at the feeding rollers.

The sliver delivered by the roller, proceeds next to a large bobbin or cylinder, round which it is lapped, till the whole combing is entirely wound up. It is again passed through another chain-comb like the preceding, furnished with finer and closer-set teeth; and in this process the sliver is doubled, to give greater uniformity to the fleece. The person who attends this machine, (invariably a young boy or girl,) is called the feeder. His business is to weigh the wool, and spread it in definite quantities on a travel-

ing apron, which feeds the first pair of rollers. The attention of the feeder is necessarily invariable while the engine is at work, as the uniformity of the thread finally produced depends, in no small degree, on his accuracy. The film of wool at open drawing, on its delivery from its first pair of rollers is collected through a funnel mouth, and either lapped on a cylinder or received in a tin can, and broken off when the can is full. An empty can is then set in the place of the full one.

The machines for reducing, and at the same time equalising, by doubling the open drawings of long wool, are constructed on the same principle as the drawing frame of a cotton-mill, only the distance between the first and last pair of rollers is much greater, on account of the greater length of the wool-staple. The drawing operation is performed by the first pair of rollers moving more slowly than the last pair, whereby the soft woolly riband is extended in length proportionally to that difference of velocity.

Hitherto, no degree of torsion has been given to the slender fillet; but a little twist must now be introduced to preserve its cohesion, in its progression towards the state of a fine thread.

The following description of a roving apparatus for long wool will communicate a tolerably distinct idea of the process.

The sections of two pair of rollers, the lower ones being made of iron, and fluted; the upper being of wood, covered with leather. Pressure is exercised by the upper on the under ones by means of weights suspended by curved rods from the ends of the axes of the upper rollers. The first roller moves faster than the second, in the proportion of two and a half or three to one, according to the nature of the wool. The second roller rests on a moveable bearer, which permits it to be placed nearer to, or farther from, the first roller. A cylinder mounted with pins, which revolves very slowly on its axis, and delivers to the second roller, moving with a treble velocity, the open drawings of wool supplied by the feeding roller. A spindle, having one leg of its forked flyer tubular, through which the roving passes in its way to the bobbin. The spindle turns very slowly, so as to give no more twist to the filaments than may be necessary to secure the formation of an uniform soft cord during their extension. The up and down motion of the bobbin is given by an eccentric acting on the copping-rail.

The general manner of spinning long wool into a finer thread:—Here are three pairs of drawing rollers; the first two of which are supported on moveable bearings, or brass brushes, which allow of their being separated, more or less, from one another, and also from the other roller, to suit the staple of the wool. The ratio of the speed of the first and last pair of rollers is as one to four. The roller serves merely to bear up the fine roving; its velocity is therefore a mean between that of the other two. The bobbins filled with rovings made on the previously described machine, are arranged, behind the back drawing roller, in a creel-frame, so that three rovings together may pass through the funnel or eyelet, placed opposite the middle of this roller. The roving is never reduced to its ultimate fineness by passing through two or three such machines, but it passes successively through five or six of them, receiving not only extension, but an equalising combination every time. At last, the fine yarn is formed by a spinning frame, or throstle, which may contain two hundred and fifty-four spindles on each side, furnished with a four-fold set of drawing rollers. The back and the front

pairs of rollers alone are loaded by a suspended weighted lever. The upper rollers of the two middle pairs are of lead, and press merely by their weight. The ratio of the velocities of the extreme pairs of rollers is here as one is to six, eight or ten, according to the fineness of the roving, and the number of yarn wanted. In this final spinning there is no doubling operation; but single bobbins are set on skewers in the reel in correspondence with the single spindles on the copping rail. The number of doublings in this process of drawing and roving long wool, may amount in certain cases to several thousand.

The spindles should revolve very quickly in the spinning frame, in order to give the requisite degree of twist to the worsted. The hardest twisted worsted is called *tammy* warp; and when its fineness is such as to contain twenty-four hanks to the pound weight, the twist is about ten or twelve turns in every inch length. The least twist is given to the hosiery worsted yarn, which runs from eighteen to twenty-four hanks to the pound weight. The twist is only from five to six turns per inch. The degree of twist is regulated by the size of the wharves or whorls upon the spindles, and the speed of the front rollers, in the spinning of which, on the fine mule, extraordinary nicety of adjustment is required.

A hank of worsted yarn contains five hundred and sixty yards; and it is divided into seven lays, of eighty yards each. Some count hanks of eight hundred and forty yards, like those of cotton yarn.

The roving frames have much fewer spindles than the fine spinning frame; some of them are two spindle, some of them four spindle, others six spindle-frames, &c., which all repeat, however, the similar process of doubling threads and passing under drawing rollers, so as to give successive draughts to the spongy cords, and to maintain their perfect equality of texture. Girls from sixteen to twenty and upwards, are generally employed at drawing, roving and spinning frames. At the former two they earn from 6*s*. to 7*s*. each, weekly; at the last, from 9*s*. to 10*s*.

Dates of Circumstances and Occurrences connected with Manufactures.

1756. Cotton velvets and quiltings first made in England.

1768. The stocking frame applied to make lace by Hammond.

1774. A bill passed to prevent the export of machinery used in cotton factories.

1779. Mule spinning, by Crompton.

1794. Sewing cotton made by S. Slater.

1803. First cotton factory in New Hampshire.

1810. Digest of cotton manufactures in the United States by Mr. Gallatin, and another by Tench Coxe, Esq; and public attention drawn to their growing importance.

1815. The power loom introduced into the United States, by Gilmore, (R. I.) afterwards more perfectly at Waltham, Massachusetts, where the latest improvements in machinery were obtained.

1822. First cotton factory erected at Lowell.

1825. Self-acting mule spinner patented in England, by Roberts. Same year the tube frame introduced there from America.

1826. First exports of American cotton manufactured to any considerable value.

1830. Mr. Dyer introduces a machine from the United States into England, to make cards.

1831. Calico Printing much improved in the United States.

1834. A patent for an improved spindle, by Charles Jackson, Esq. Providence R. I.

1835. April 20. "Died at Webster, Massachusetts, aged 67, Samuel Slater, long known as an enterprising and respected citizen of Rhode Island, and the father of the cotton manufacturing business in this country, in which he acquired a great estate. The first cotton manufactory in the United States, was built by Mr. Slater, at Pawtucket R. I., which was standing and in operation at the time of his death."—*American Almanac.*

1836. One hundred and twenty millions of yards of calico printed in the United States, during the year ending April 1, 1836.

INDIANS.

Their arts and manufactures were confined to the construction of wigwams, bows and arrows, wampum, ornaments, stone hatchets, mortars for pounding corn, to the dressing of skins, weaving of coarse mats from the bark of trees, or a coarse sort of hemp, &c. In summer, they wore little besides a covering about the waist; but in winter, they clothed themselves in the skins of wild beasts. For habitations, the Indians had wigwams. These consisted of a strong pole erected in the centre, around which, at the distance of ten or twelve feet, other poles were driven obliquely into the ground, and fastened to the centre pole at the top. Their coverings were of mats or bark of trees, so well adjusted as to render them dry and comfortable. Their domestic utensils extended not beyond a hatchet of stone, a few shells, and sharp stones which they used for knives, stone mortars for pounding corn, and some mats and skins upon which they slept. They sat, and ate, and lodged, on the ground.

1678. The colonists during this period, being chiefly occupied in gaining a subsistence, and in protecting themselves against their enemies, had occasion for few articles beyond the necessaries and comforts of life. Arts and manufactures could, therefore, receive but little encouragement, beyond the construction of such articles, and even those were principally imported.

In 1620, one hundred and fifty persons came out to Virginia to carry on the manufacture of silks, iron, potash, tar, pitch, glass, salt, &c. but they did not succeed. In 1673, Chalmer says of New England, "There be five iron works which cast no guns, no house in New England has above twenty rooms —not twenty in Boston have ten rooms each. All cordage, sailcloth, and mats, come from England—no cloth made there of any value—no alum, no copperas, no salt made by their sun. The first buildings of the settlers were made of logs and thatched, or were built of stone. Brick and framed houses were soon built in the larger towns; the frames and brick were, however, in some instances imported. The first mill in New England was a windmill, near Watertown, but it was taken down in 1632 and placed in the vicinity of Boston. Water mills began to be erected the next year. The first thing printed was the freeman's oath, the second an almanack, and the third an edition of the psalms. The bible was printed at Cambridge in 1664, translated into the Indian language. Notwithstanding the obstacles interposed

by Great Britain to the progress of arts and manufactures, the coarser kinds of cutlery, some coarse cloths, both linen and woollen, hats, paper, shoes, household furniture, farming utensils, &c. were manufactured on a small scale, but not sufficient to supply the inhabitants; cloths were made in some families for their own consumption. In 1700, which was the time of the commencement of the first newspaper, there was but a moderate advance for some years. The trade with England during the revolutionary war being interrupted, the people were compelled to manufacture for themselves. Encouragement was given to all necessary manufactures, and the zeal, ingenuity, and industry of the people, furnished the country with articles of prime necessity, and in a measure, supplied the place of a foreign market. Such was the progress in arts and manufactures, that after the return of peace, when an uninterrupted intercourse with England was again opened, some articles, which before were imported altogether, were found so well and so abundantly manufactured at home, that their importation was stopped, and arts and manufactures attracted the attention of government. A. Hamilton, secretary of the treasury, made a report to congress on the subject, in which he set forth their importance to the country, and urged the policy of aiding them. Since that time the revenue laws have been framed with a view to the encouragement of manufactures, and their promotion has been considered as a part of the settled policy of the United States. Although the flourishing state of commerce attracted the attention, and absorbed the capital of the country in some degree to the exclusion of other subjects, still manufactures began to progress.

From Hallam's History of the Middle Ages.

The condition of internal trade was hardly preferable to that of agriculture, which was wretched. There is not a vestige perhaps to be discovered for several centuries of any considerable manufacture; I mean, of working up articles of common utility, to an extent beyond what the necessities of an adjacent neighbourhood required. Rich men kept *domestic* artisans among their servants; even kings, in the ninth century, had their clothes made by women upon their farms. The only mention of a manufacture, as early as the ninth or tenth centuries, is what Schmidt says, that cloths were then exported from Friseland to England and other parts. Venice took the lead in trading with Greece and more eastern countries. Amalfi had the second place in the commerce of those dark ages; the fine cloths of Constantinople were imported. It is an humiliating proof of the degradation of Christendom, that the Venetians were reduced to purchase the luxuries of Asia, by supplying the *slave-market* of the Saracens.

Netherlands, coasts of France, Germany, Scandinavia, and the maritime districts of England, were first animated by the woollen manufacture of Flanders. It is not easy either to discover the early beginnings of this or to account for its rapid advancement. Several testimonies to the flourishing condition of Flemish manufactures occur in the twelfth century, and even earlier. A writer of the thirteenth century asserts, that all the world was clothed from English wool wrought in Flanders; they were probably sold wherever navigation permitted them to be carried. Flanders was a market for the traders of all the world. England soon began to share in the trade.

The History of Norfolk speaks of a colony of Flemings settling as early as the reign of Henry II. at *Worsted*, and immortalised its name by their manufactures. There were several guilds of weavers during the reign of Henry II. Edward III. may almost be called the father of English commerce, a title more glorious than hero of Cressy. In 1331 he invited the manufacturers of Flanders into his dominions. They brought the finer manufacture of woollen cloths which had been unknown in England. Commerce became a leading object with parliament. There were inducements held out to the Flemings: "Here they should feed on fat beef and mutton, till nothing but their fulness should stint their stomachs; their bed should be good, and their bed-fellows better, seeing the richest yeomen in England would not disdain to marry their daughters unto them, and such the English beauties, that the most envious foreigners could not but commend them."

THE END.

Silk Loom exhibiting Mr. Richardss improved Drawboy.