LIN'EN, *n. s.* & *adj.* } Sax. linen; Goth.
LIN'ENER. } *lin;* Teut. *lein,* flax; Lat. *linum;* Gr. λινον. Cloth of hemp or flax.

And thei tooken the bodi of Jhesus and bounden it in *lynnun* clothis with swete smellynge oynementis, as it is the custom to iewis for to byrie.
Wiclif. Jon. xx.

Here is a basket, he may creep in; throw foul *linen* upon him, as if going to bucking. *Shakspeare.*

A *linen* stock on one leg, and a kersey boot hose on the other, gartered with a red and blue list. *Id.*

Death of thy soul! those *linen* cheeks of thine
Are counsellors to fear. What soldiers, whey-face?
Id.

Where is my fashioner? my feather-man?
My *linener,* perfumer, barber? *Ben Jonson.*

Unseen, unfelt, the fiery serpent skims
Between her *linen* and her naked limbs.
Dryden.

A pampered spendthrift, whose fantastic air,
Well fashioned figure, and cockaded brow,
He took in charge, and underneath the pride
Of costly *linen* tucked his filthy shroud. *Young.*

A drawer, it chanced, at bottom lined
With *linen* of the softest kind,
With such as merchants introduce
From India, for the ladies' use. *Cowper.*

LINEN. The fabrication of linen is a most important branch of the staple manufactures of Great Britain. On this account we have already fully examined the agricultural processes connected with the cultivation of flax; the dressing of hemp has also been briefly considered, and we must now proceed to the operation of spinning.

The most ancient mode of *spinning* is by the spindle and distaff, and this method is the simplest of all others. The spindle is nothing more than a piece of hard wood, made round, and sharp pointed at one end, so that it can be made to whirl upon its point in the same manner as a child's top: the upper part is reduced to a pin or peg, and it is this part which has the fibres united to it, the lower or enlarged part being only to give sufficient weight to make it revolve. The spinner must be seated upon the ground, and after having put the distaff in motion upon its point, by twirling it between the hands, get it up to a rapid motion by striking it occasionally with the hand, with a motion very similar to that by which a child keeps up the motion of his whipping-top, when he draws the lash of a whip round it.

The flax, after having been properly prepared, is lapped round the end of the distaff, which is nothing more than a stick that the spinner holds in his left hand, so as to be conveniently situated to draw off from it a few fibres at a time with the finger and thumb of the right hand, to form the thread. The upper part of the spindle, which is made smaller like a pin, has the ends of the fibres which are to form the thread attached to it before it is put in motion. These fibres are drawn out of the bunch which is wound upon the distaff, and held between the finger and thumb, so as to be in the direction of the length of the spindle; therefore, when the spindle is once made to revolve, it twists these fibres together, to form a thread, and, as fast as the thread forms, the spinner draws off more flax from the distaff, and guides the fibres between the finger and thumb, so that they shall be regularly delivered out, and make an even thread. The motion of the spindle is constantly kept up, by striking it as often as the hand can be spared from the operation of guiding the thread. When by these means as great a length of thread is formed as is convenient to reach from the end of it to the spindle, the thread is wound upon the outside of the small part or pin of the spindle, for which purpose the spinner applies the fore-finger against the thread, close to the end of the spindle, and bends the thread at that part, so that it will be at right angles with the direction of the spindle, instead of being nearly in the direction of its length; and also, that it will be guided opposite to the middle of the pin, or small part of the spindle, instead of being at the extreme end thereof. In this situation the motion of the spindle, which is continually kept up, occasions the thread to wind up, or lap upon the pin of the spindle, instead of twisting round upon itself, as in the former case; but, when nearly all the length of thread is thus disposed of, the finger is removed from the thread, and it immediately assumes its original direction, by slipping to the extreme end of the spindle, so as to be twisted round itself by the motion of the spindle, and more fibres are now supplied to it from the bunch upon the distaff, to form a fresh length of thread. In this manner the spinning proceeds, until as much thread is spun and wound upon the pin of the spindle as will make a moderately sized ball.

This simple and inconvenient method of spinning becomes very efficient, when the spindle, instead of being spun upon the ground, is mounted in a proper frame, and turned by a wheel and band; this forms a machine which is called the one-thread wheel, and is still used in some parts of the country for spinning wool: the spindle is made of iron, and placed horizontally, so that it can revolve freely; and the extremity of the spindle, to which the thread is applied, projects beyond the support.

The wheel which turns it is placed at one side, the pivots of both being supported in upright pieces, rising up from a sort of stool. The spinner puts the wheel in rapid motion by its handle, and its weight is sufficient to continue the motion for some seconds; then walking backwards from the spindle, in the direction of its length, she supplies the fibres regularly, and the motion twists them into a thread; but, when a convenient length is spun, the spinner steps on one side, and reaches out that arm which holds the end of the thread, so as to alter the direction of the thread, and bring it nearly perpendicular to the length of the spindle, which motion gathers or winds up the thread upon the middle of the projecting part of the spindle. This being done, she holds the thread in the direction of the spindle, so that it will receive twist, and retreats again to spin a fresh length of thread.

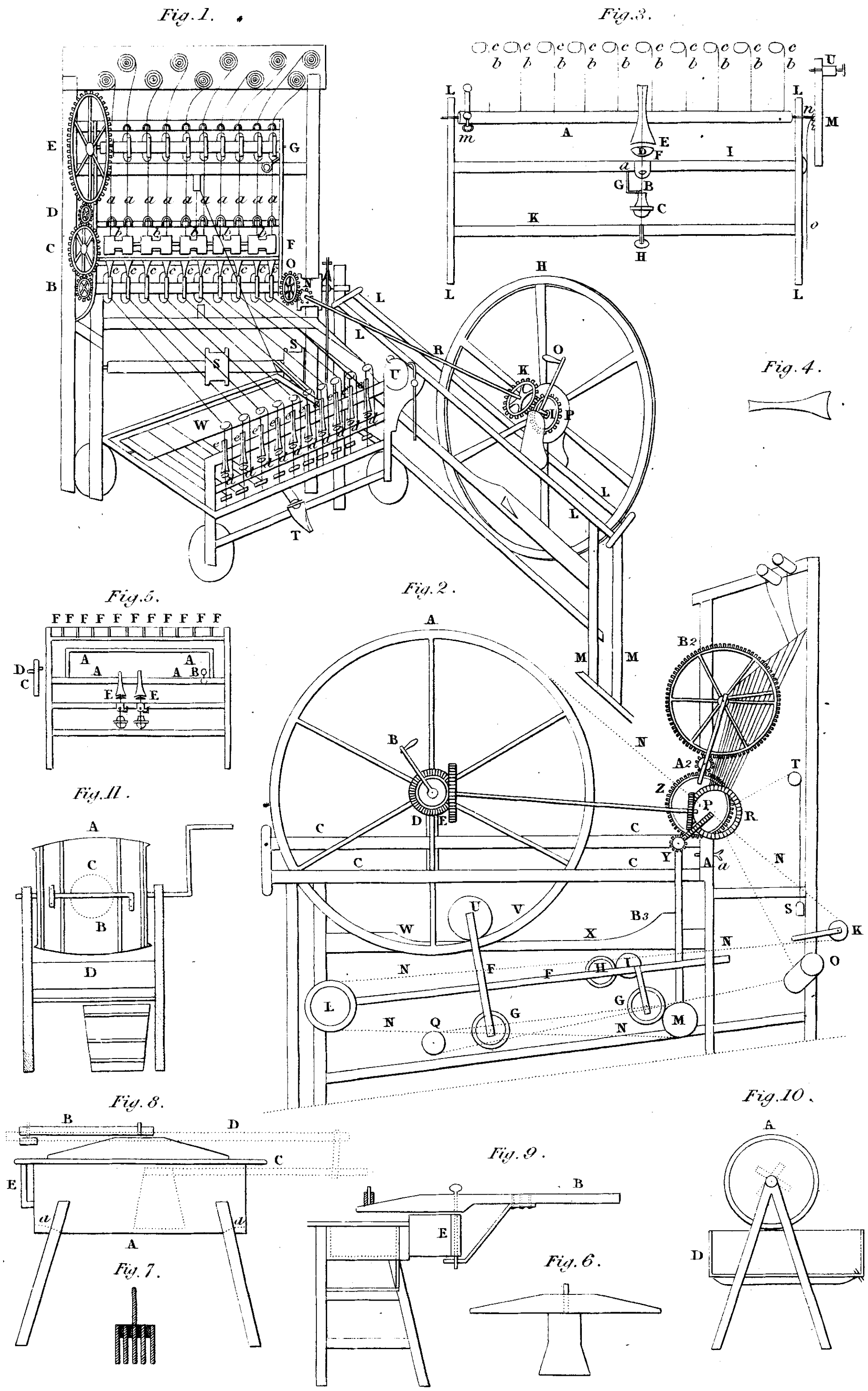
A *spinning-machine* more perfect than this is the one-thread flax-wheel, with spindle and flyer; it has the property of constantly drawing up the thread as fast as it is spun, instead of spinning a length, and then winding it upon the spindle. For this purpose the spindle is made longer than the other, and is turned by a band and wheel; but the wheel receives motion from the foot by a small treadle, because the spinner sits before the wheel to work the spindle, which is supported upon its two extreme ends, and near one end the flyer is fixed; this is a piece of wood curved to an arc, the vertex of which is fixed on the spindle, and from the extremities of the arc two arms proceed, so as to be parallel to the spindle, and at such a distance from it as to admit a wooden bobbin to be fitted loosely upon the spindle; and at the same time the arms of the flyer can revolve round the bobbin without touching it. The end of the thread is fastened to the bobbin, and conducted through a hook fixed in the flyer, so that it proceeds from the circumference of the bobbin to this hook, in a direction perpendicular to the bobbin, but turns round the hook so as to come into the direction of the spindle.

The thread is then conducted through a perforation made in the centre of the end of the spindle or pivot, upon which it revolves, and to this end of the thread the fibres are supplied. The twisting motion given by the revolution of the spindle forms them into a continuation of the thread, which is gathered up upon the bobbin as fast as the spinner lets it go through her fingers, by a tendency which the bobbin has to turn slowly, at the same time that the flyer to which the thread is hooked is revolving rapidly round the bobbin. For this purpose a string is passed round a small neck upon the bobbin, and, one end of the string being fastened to the frame, the other has a small weight to draw it tight round the neck of the bobbin, and occasion friction.

In other spinning wheels a second band from the great wheel is made to turn the bobbin more slowly than the spindle. The thread which passes over the hook of the flyer is rapidly carried round the circumference of the bobbin; but, as the bobbin follows the motion of the flyer, it only winds up as much thread upon the bobbin as the difference of the two motions; and this tendency to wind up can be increased or diminished at pleasure, by the friction which is occasioned by the string or band which passes round the neck of the bobbin. When the winding-up of the thread upon the bobbin has accumulated a ridge of thread, upon it opposite, to the hook in the flyer, the thread must be shifted to another hook opposite to a different part of the bobbin, for which purpose the arms of the flyer are furnished with different hooks, and this must be repeated several times, until the whole length of the bobbin is filled; it is then taken off to be reeled, and replaced by another empty bobbin.

An improvement was made in the *spinning-wheel* by Mr. Antis some years ago, which was an application of what Sir Richard Arkwright had before invented. The object is to obviate the necessity of stopping the wheel to remove the thread from one hook to another, in the manner just described. For this purpose, the bobbin is made to move regularly backwards and forwards upon the spindle a space equal to its length, so that every part will, in succession, be presented opposite the hook over which the thread passes, and thus receive the thread regularly upon the whole length of the bobbin. The additional parts necessary for producing this movement are as follow: a pinion of only a single leaf is made to project from the extremity of the pivot of the great wheel, or a worm or endless screw formed on the end pivot will answer the same purpose, which is to actuate a wheel of seven inches diameter, and ninety-seven teeth; therefore ninety-seven revolutions of the great wheel will produce one revolution of this smaller wheel; upon the face of which a circular ring of wire is fixed, and supported from the wheel by six legs, so as to be oblique to the plane of the

LINEN MANUFACTURE.



London. Published by Thomas Tegg, 73, Cheapside, January 1, 1828. J. Shury. sculp.

wheel, as it touches it at one part, and at the opposite side of the ring projects nearly three-quarters of an inch. This ring of wire gives motion to an upright lever, about fifteen inches long and moving on a centre at three inches from its lower extremity, where it has a pin fixed in it and resting against the oblique ring of wire; therefore, when the wheel turns round, it communicates a small motion to the lever in consequence of its obliquity to the plane in which it revolves. The upper end of the lever is connected to an horizontal sliding-bar situated beneath the spindle, and having an upright piece of brass, which works in the notch of a pully formed in the ends of the bobbin, and drives the bobbin backwards and forwards upon the spindle, according as the oblique ring of wire forces the pin at the lower end of the lever in or out, when the wheel moves round. To regulate and return this alternate motion, a small weight hangs by a line to the sliding-bar, and, passing over a pulley, rises and falls as the bobbin recedes and advances, and tends constantly to keep the pin at the lower end of the lever in contact with the wire. It is evident from this description, that one staple only is wanted to the arms of the flyer, which being placed near the extremity, the thread passes through it, and by the motion of the bobbin is laid regularly upon it from one end to the other.

The invention has also another advantage over the old method, which always winds the thread in ridges upon the bobbin; and, if the thread breaks in reeling the yarn, the whole bobbin may as well be thrown away, because the thread cannot easily be found again; but this improved wheel always winds the threads across upon one another, by which means the end can never be lost.

In order to regulate the friction on the bobbin, and retard its motion in a greater or less degree at pleasure, there is a neck of brass or steel fastened to one end of it, and embraced by a kind of small vice, or pincers, fixed to the sliding-bar. This vice must be made either with two elastic springs with wooden tops, or of wood wholly, and faced with leather; but, if made of wood only, then a spring must be made beneath the shoulder of the screw, to answer the same purpose. By tightening this screw, more or less, the friction on the bobbin may be regulated to the greatest nicety, provided the springs are of a strength rightly proportioned to their functions. It will readily appear, that all this may be done without the least effect on the velocity of the whole machine, as thereby nothing is added to the general friction so as to obstruct it.

We shall now proceed to give a description of a patent, obtained in 1806, by Messrs. Clarke and Bugby, for effecting certain improvements in a *machine*, intended to be worked by hand-labor, for the spinning of hemp, flax, &c.:—

Plate Linen Manufacture, fig. 1, represents an oblique view of the front of a frame containing ten spindles (but the frames may contain an indefinite number of spindles). A, the spindle or a bow passing through the whole frame, having ten bosses of brass or cast-iron thereon, each about four inches diameter, each boss supplying one spindle; B, a pinion of twelve leaves upon the end of the spindle A, connected with the wheel C, of eighty teeth, fixed upon the end of a small iron spindle F, covered with wood, and extending through the whole frame; D, a slack or intermediate pinion of any size at discretion, connected with another similar pinion, the latter connected with a wheel of 120 teeth, which is fixed upon an iron spindle G, of about an inch and a half in diameter, and extending through the whole frame; but the wheels B, C, D, and E, may be varied in their numbers, to increase or diminish the draught of the substance operated upon, as may best suit its quality or the ideas of the workman. The pinion B is so contrived as to slip off the end of the spindle A, to make room for a smaller or larger one; by means whereof a larger or shorter thread may be spun from the same sized rovings; *a a a a a a a a a a* represent ten roved slivers of hemp, flax, tow, or wool, passing between the iron spindle G and rollers in pairs pressed against them by springs or weights; these springs or weights must operate with sufficient force to hold back the slivers or rovings so securely, that they may only pass on with the movement of the spindle; these pairs of pressing rollers are placed behind the spindle. The use of the small iron spindle F, covered with wood, and left rather larger than the spindle G, is, with pressure of the small wood-roller, made up in pairs *b b b b b*, and so contrived that each pair may roll upon two slivers, to bring them down straight, and preserve the twist which they receive in the roving-machine till the slivers leave them. The bosses on the spindle A, have likewise wooden rollers in pairs pressed against them by springs or weights, between which the drawn, lengthened, or extended slivers pass to the spindle, the rollers having each a tin conductor, *c c c c c c c c c c*, to bring the material under operation as centrically as possible between the wood-rollers and the bosses; but all the above-mentioned parts of the machine are so similar to the common upright frames, that a person conversant with them will not be at a loss to understand its arrangement. H, is a wheel of wood four feet in diameter, having its rim about two inches thick, with a groove in its periphery for a small cord or band. In its centre is a rule or stock of wood, through which the spindle I passes, and extends into its frame about one-fourth of its length. To enable the person that turns the winch to reach all the spindles at work, with the hand that is not engaged in turning, to remove any obstacle that may arise to the spindles, the arbor or spindle of the wheel I has its bearing on the sides of the frame that contains it, marked L L L L; this frame, with the wheel H, the arbor I, and the winch K, is similar to that part of a machine called a mule-jenny, used for spinning cotton; this frame is supported in a horizontal position at the outer end by two legs marked M M, and a screw-pin which passes through K, the front upright *a* A, fig. 2, and made tight with the thumb-screw *a*; the screw passes through a groove or mortise at the end of the wheel frame, to enable the workman to adjust the wheels N and O, as it will be found necessary to change the wheel N, to make such alteration in the twist as the size of the yarn may require, or as the workman may think proper. P and Q are bevel wheels of equal size, the former fixed upon the rule or stock of the wheel H, and connected with Q upon the spindle R, taking round with it the wheel N, which is connected with the wheel O. Upon the embossed spindle or arbor A, *a a a a a a a a a a*, are spindles standing on a carriage with four wheels, similar to the carriages used in mule-jennies for spinning cotton, having at each of them, at *d d d d d d d d d d*, a convex seat of wood of any convenient size, not less than the bottom of the bobbins or quills *e e e e e e e e e e*; these bobbins or quills are about six inches long and one inch and a quarter diameter at the bottom, and three quarters of an inch diameter at the top; but the sizes must be varied according to the size of the yarn. Perhaps four or five variations will be sufficient to spin yarn for tarpaulins or sail-cloth, up to fine yarn fit for good dowlas and fine stockings. T, a pulley, over which a band, from S, runs and returns, to draw out the carriage upon the four wheels described; W, the cylinder which drives the spindles.

Fig. 2 exhibits a side view. A, the wheel mentioned above in fig. 1, and there marked H; B, the winch by which it is turned by hand; C C C C, the frame wherein it works; D and E are blocks of wood on each side of the said frame to raise the wheel, so that the winch may be clear of the carriage F F, and apparatus G G; the two end wheels upon the carriage containing the spindles having two more corresponding on the opposite side thereof. H, a groove upon the end of a cylinder, which drives the spindles, and stretches through the carriage-frame, for the diameter of which no certain rule can be laid down, as it depends upon the length or size of the yarn, taken into account with the other parts of the machinery. N N N N N N N, a small band passing over the wheels A K, H I L, and M, by which the groove-wheel H and its cylinder are moved, and the spindles driven. O, a treadle shaft, represented by S S, fig. 1, passing through the frame or part thereof at the option of the workman, connected with a tumbler at the end of the embossed spindle or arbor A, in fig. 1, by a small band, wound five or six times round each of them, and passing over the wood groove-wheel Q, and made fast to the back of the carriage F F; this tumbler, by the motion of A, is, at the return of the carriage, locked to the wheel R; and unlocked when the carriage is not in its proper situation.

The carriage is drawn on by the weight of S fastened to a cord, which passes over the groove-wheel T, and is connected with the front of the carriage; U, the wheel on the arbor containing the holder shown in fig. 1; V, the cylindrical roller on a stirt fixed therein, and rolling at every return of the carriage on the plane W and X, which raises and falls the fallers and holders, so as to distribute the yarn upon the bobbins from the top to bottom; the wheels Y Z, A 2, and B 2, are the same wheels shown by B, C, D, and E, in fig. 1; 1, 2, &c., spools containing the rovings.

This machinery is calculated to save the heavy expense of currents of water, erecting spacious buildings, water-works, steam engines, &c., and to spin hemp, flax, &c., at such an easy expense as to bring it within the reach of small manufactories. This machinery is also constructed upon such safe and simple principles, that no length of experience is necessary to enable even children to work it; and the use of water, steam, &c., being rendered unnecessary, it occupies so little space, that it may be placed in small rooms, out-buildings, or other cheap places. To effect the above purpose, it was necessary to get rid of the lanier or flyer, upon the spindle used in the old machinery for spinning hemp and flax, which requires a power in proportion of five to one, and to surmount the difficulty that arose from the want of elasticity in these substances. This want of elasticity, in the substance to be operated upon, is compensated and provided for in this machinery; and upon this composition and provision, effected by the various means hereafter mentioned, the return of the carriage without any assistance from the work-person, and the traverse for distributing the yarn upon the bobbins or quills, lay the stress upon the patent. The most simple mode of compensating the want of elasticity, and which is recommended in preference to the other, is that of having a holder of large wire for every spindle, fixed in an arbor or shaft extending from one end of the carriage to the other.

This arbor or shaft, with the holders, may be considered as a large and improved substitute for what is called a faller in the mule-jennies for spinning cotton, fig. 3. Let A represent the arbor or shaft, *b b b b b b b b b b* the holders fixed therein with the elliptical eyes, through each of which a thread passes from the bosses on the arbor A, in fig. 1, to its spindle. B, a spindle, which may be from ten to thirteen inches long; C, the whirl, wherein a small worsted band from the cylinder H, fig. 2, works D, a convex seat upon the spindle, whereon the concave bottom of the bobbin or quill E rests.

F, a piece of buffalo skin, or metal, screwed or nailed to the rail I, having a hole in it, through which the spindle passes, and by which it is kept steady; G, a wire bent at right angles at *a*, and the bent part driven into the rail A, so that it may be removed to or from the whirl C, and, by the other crook *b*, prevent the spindle from running out of its step H, which is a screw of brass or other metal passing through the rail K. The wire of which the holder is made, after forming the elliptical eye, is left or extended beyond the uppermost part at *e*, that the yarn may be conveniently slipped in when occasion may require it; these holders for each thread are for the purposes of keeping the yarn in a state nearly vertical over the tops of the spindles when the carriage which contains them is coming out, and being released from that situation at the beginning of the carriage's return, and thrown into nearly a horizontal position, so as to bring the yarn below the top of the bobbins or quills upon the spindles; and then being curved and raised again by the wheel U, and its cylindrical roller moving upon the plane W and X, fig. 2, distributes the yarn upon the bobbins or quills, and prevents it from cockling, hinkling, or improperly doubling or twisting together. The seats upon the spindles described by D, are turned convex, and the bottoms of the bobbins and the bottoms of the quills concave, to keep the bobbins or quills in a more central state upon the seats. The concavity of the bobbins or quills, exceeding the convexity, throws the weight of the bobbins or quills upon the peripheries or extremities of the seats, and ensures the rotatory motions of the bobbins or quills with that of their spindles. We prefer the convex and concave surfaces before described; but other surfaces will have nearly the same effect, if so contrived (as they easily may be) to bear upon the peripheries or extremities of the seats, as well as of the bobbins or quills. The hole through the bobbin or quill, fig. 4, is rather larger than the spindle, that it may not be obstructed in its motion round the spindle, which motion takes place at every return of the carriage, and as often as any thing obstructs the coming forward of the sliver of which the yarn is formed. At one end of the arbor whereon the holders are fixed is a counterpoise L, fig. 3, having a socket, and made fast; the arbor by a thumb-screw *m*, the round ball at the top being led to counterbalance the holders. This counterpoise, when the holders are in a vertical state, declines about 10° or 15° towards the horizon; but when the holders are thrown down, and under the government of the cylindrical roller V, upon the wheel U, is in a different situation; but the roller V, arriving at B 3, fig. 2, on the return of the carriage, the holders are precipitated to a height where the counterpoise overbalances them, and locks the wheel M fig. 3, or U in fig. 2, in the ratchet *n*, where it remains until the carriage has reached its destined place, where the tail of the catch O strikes against the pin in a frame C C C C, fig. 2, and releases it, the said roller then resting upon the frame U X. A second method of compensating and providing for the want of elasticity in hemp and flax, which is a part of the discovery, is, to fix a round bar of wood, about an inch and a half in diameter, the whole length of the carriage, about three or four inches above the tops of the spindles, so that the outer surface, or that next the work-person, may be perpendicularly, or nearly so, over the tops of the spindles, the inner side having pieces of wood or metal nailed or otherwise fixed thereto, leaving only small spaces between each for the yarn to pass through; the use of these pieces is to prevent the threads getting together and entangling, see fig. 5. A A A A represents a common faller used in the mule-jennies for spinning cotton with counterpoise B, wheel C, with its cylindrical roller D, with the plane W and X, before described by figs. 1, 2, and 3; E E, spindles with their whirls, convex seats, bobbins or quills, with their concave bottoms; F F F F F F F F F F the pieces of wood or metal, nailed or otherwise fastened to the round piece of wood, to prevent the thread getting together. In this case every thing applied to or used with the arbor, containing the holders above mentioned, may be applied or used.

The bleaching of linen being a purely chemical art, it might be expected that the knowledge of the instruments it employs would keep pace with the progress and improvements of that science to which it is subordinate, and so much the more as the nature of alkaline substances in general, which are its proper instruments, has been in a great measure explained by the celebrated Dr. Black. Yet it has so happened, when a scarcity of these saline substances unhappily prevailed in this kingdom, it was seriously questioned whether their place could be supplied by materials manufactured at home. Mr. Kirwan very minutely examined the various processes that had previously been resorted to, and the result of his labors is given in a very valuable paper in the Transactions of the Royal Irish Academy. He commences with barilla. Of this substance there are several sorts, made of different plants; but the best is that formed near Alicant, at a distance from the sea, by the combustion of a plant called by the inhabitants barilha, and described by Jussieu, in the memoirs of the Academy of Paris for 1717, under the name of kali hispanicum, supinum, annuum, sedi foliis brevibus. It seems to be classed by Linnæus under the pentandria digynia, by the name of sal sola vermiculata frutescens foliis ovatis acutis carnosis, and should carefully be distinguished from the various kinds of salicornia which he ranges under the title of monandria monogynia; and also from other plants which he calls chœnopodia, which yield an alkali, but less pure than the salsola. These plants, being dried to the same degree as hay, are burned in pits nearly as kelp is with us, the ashes and salt run into a grayish blue mass, which is the barilla. The best sort is here called sweet barilla.

The sweet barilla examined by Mr. Kirwan was of a bluish color, covered over with a saline powder exceedingly hard, and had a smart alkaline taste. When broken, it looked black in the fractured part, and visibly contained pretty large pieces of charcoal. To find the proportion of fixed air in this substance, having reduced a quantity of it to fine powder, he poured on an ounce of it a sufficient quantity of marine acid, and found it to lose by the action of this acid eighty grains of its weight; consequently one pound troy of this substance contains 960 grains of fixed air (mixed with a little that had an hepatic smell), that is exactly one-sixth of its weight. Other parcels contained somewhat more, and others somewhat less.

As this substance evidently contained some parts that were soluble in water, and some that were insoluble therein, to discover the weight of each, Mr. Kirwan poured on one pound of it, reduced to fine powder, thirteen pounds of water, moderately hot, successively; this water had previously been boiled and filtered, and contained no other impurity than a slight trace of common salt. This quantity of water was necessary to exhaust all the soluble matter in the barilla. The solutions were taken in six different portions: none of them betrayed the smallest trace of sulphur, nor did the Prussian alkali discover any vestige of iron. By eighteen successive evaporations and crystallisations, he obtained 4881 grains of saline matter, and 2903 of insoluble matter.

It may at first sight appear extraordinary that the saline matter and the insoluble part should weigh more than the pound of barilla that seemed to afford them; for this amounts only to 5760 grains, and the two former weigh 7784 grains; but it should be considered that these products were obtained not from the barilla alone, but from the barilla and the water in which the salts were dissolved, whose crystals retained a great quantity of it, and also from the air to which the solutions were exposed, and which they absorbed in large proportion. As the quantity of the insoluble matter was subject to no such deceptive appearance, Mr. Kirwan began by examining the weight of that; for this, being subtracted from 5760 grains, necessarily determined the true weight of the saline part; as the state in which the saline part exists in barilla depends in some measure on the earths and charcoal with which it is united, as well as the most advantageous method of using it.

Having therefore dried the insoluble matter for a considerable time, in a low heat, until it appeared as dry as the barilla itself, and found its weight in that state to amount to 2903 grains, or 6·04791 ounces, Mr. Kirwan took one ounce of it, and, drying it in a heat little below redness, found it to lose thirty-eight grains of moisture. Another ounce of the same residuum, being treated with dilute marine acid, lost 125·5 grains of its weight, and this loss expresses the quantity of fixed air contained in it. Another ounce, being calcined in a white heat for about one hour, lost 200 grains of its weight; and, on repeating this experiment, he found the loss amount to 199 grains. Lastly, on the 281 grains which remained after this experiment, he poured dilute marine acid, and found the quantity of fixed air to be 106 grains.

Mr. Kirwan next examined the fixed incombustible part that remained after the above calcination. On the 279 grains of this, which remained after the calcination of an ounce of the insoluble part, he poured a quantity of distilled vinegar, whose specific gravity in the temperature of 62° was 1·008, and digested that residuum therein for sixteen hours in a heat little more than 100°. After edulcoration, and desiccation, the weight of what remained undissolved was found to amount to sixty-three grains. Upon this experiment he reasoned thus: 281 grains of a residuum of this sort contained 106 grains of fixed air, therefore the 279 grains subjected to the vinegar in this experiment must have contained 105·24, which were dissipated by the action of the acid; there remained, therefore, of mere earth only 173·76; but of these sixty-three escaped the action of the acid, therefore there were dissolved 110·76. And as distilled vinegar can act only on calcareous and muriatic earth (the barytic not being excepted), the 110·76 that were dissolved must have consisted of either or both of these, and the undissolved sixty-three grains must have been argillaceous or siliceous. The sixty-three grains, being digested in spirit of salt, left a residuum of 41·3 grains, which, therefore, were siliceous; the remainder, not being precipitable by the vitriolic acid, was consequently argillaceous earth: hence the quantities of these ingredients in 480 grains of the insoluble part of barilla were found to be :—

		In the whole soluble part.
	grains.	grains.
Fixed air . .	125·5	759
Water	38	229;82
Charcoal . . .	142·5	861·82
Calcareous earth	89·76	542·86
Muriatic . . .	21	127
Argillaceous . .	21·7	131·23
Siliceous . . .	41·3	249·58
	479·76	2901·31
Error .	24	Error 1·69
	480·00	2903·00

We may now return to the soluble part of the barilla, which necessarily amounted to 2857 grains. In the first place, Mr. Kirwan obtained 4213 grains of pure crystallised mineral alkali: but these crystals are known to contain but one-fifth of real alkaline substance, the remainder being fixed air and water of crystallisation; therefore, one pound of barilla contains but 842 grains of pure real alkali. Besides this, he also obtained 127 grains of a mixture of vegetable and mineral alkali, with a small proportion of extractive matter, and some digestive salt; this mass constantly attracted moisture. These solutions afforded also 125 grains of Glauber's salt, and seventy of common salt; but the Glauber's salt, at least, did not exist in a crystallised form in the barilla; and, as 100 grains of it are reduced to forty-two by expelling the water of crystallisation, no more than fifty-three grains of it can be deemed to have pre-existed in the barilla. Hence the weight of the different ingredients contained in one pound of sweet barilla is as follows :—

Fixed air . . .	960	
Charcoal . . .	861·82	
Calcareous earth . .	542·86	1050·67
Muriatic earth . .	127	
Argillaceous . .	131·23	
Siliceous . . .	249·58	
Mineral alkali pure .	842	1219
Mineral alkali impure .	250	
Mineral alkali mixed with common salt .	127	
Glauber's salt . .	125	
Common salt . .	70	
Earth deposited . .	20	
	4306·49	
Water .	1453·51	
Total .	5760·00	

Hence we see that the alkaline part of barilla is nearly in a caustic state; for the entire pound of barilla contained but 960 grains of fixed air, and of this quantity 759 were contained in the earthy part. Therefore only 201 grains were contained in the saline part. Now 960 grains of this require for their saturation at least 700 of fixed air, therefore they wanted at least two-thirds of the quantity requisite to saturate them. Hence bleachers should not use boiling water to extract the saline substance of barilla, for the alkaline part being in a caustic state dissolves part of the coaly matter with which it is united, which sullies the solution, gives it a dark hue, and afterwards is deposited on the linen, and cannot be separated by acids.

Dantzic pearl-ash.—The quantity of fixed air and earth contained in different parcels of this substance is variable; in some ounces the quantity of fixed air was found to amount to 100 grains, in others to 115; and therefore at a medium it may be rated at 107·5 grains, or 1290 grains in one pound troy. The earth remaining after the solution of one pound amounted to twenty grains. After ten evaporations, Mr. Kirwan procured from one pound of this substance 505 grains of tartar vitriolate, the last portions of which contained some digestive salt, and also thirty-six grains of this last containing a portion of tartar vitriolate; about eighteen grains of earth were deposited during the evaporations. The remainder of the pound consisted of the pure alkali. Hence the ingredients in a pound must have been nearly in the following quantities:—

Fixed air	1290	
Moisture	414	
Digestive salt and ditto	36	
Tartar vitriolate	505	
Earth	38	
	2283	5760
Mere alkali	3477	2283
	5760	3477

Mr. Kirwan considers the following method much more practicable and easy than the preceding, for discovering the alkaline principle in all substances in which it exists. 1st. Procure a quantity of alum, suppose one pound; reduce it to powder, wash it with cold water, and then put it into a tea-pot; pour on it three or four times its weight of boiling water. 2dly. Weigh an ounce of the alkaline substance to be tried, powder it and put it into a Florence flask with one pound of pure water; if the substance to be examined be of the nature of barilla or potash; or half a pound of water if it contain but little earthy matter as pearl-ash; let them boil for a quarter of an hour; and when cool let the solution be filtered into another Florence flask. 3dly. This being done, gradually pour the solution of alum hot into the alkaline solution also heated, a precipitation will immediately appear; shake them well together, and let the effervescence, if any, cease before more of the aluminous solution be added; continue the addition of the alum until the mixed liquor, when clear, turns syrup of violets red; then pour the liquor, and precipitate on a paper filter placed in a glass funnel, the precipitated earth will remain on the filter; pour on this a pound or more of hot water until it passes tasteless; take up the filter and let the earth dry in it until they separate easily, then put the earth into a cup of Staffordshire ware, place it on hot sand and dry the earth until it ceases to stick to glass or iron, then pound it and reduce it to powder in the cup with a glass pestle, and keep it a quarter of an hour in a heat of from 470° to 500°. 4thly. The earth being thus dried, throw it into a Florence flask and weigh it, then put about one ounce of spirit of salt into another flask, and place this in the same scale as the earth, and counterbalance both in the opposite scale; this being done, gradually pour the spirit of salt into the flask that contains the earth, and, when all effervescence is over, blow into the flask, and observe what weight must be added to the scale containing the flasks to restore the equilibrium; subtract this weight from that of the earth, the remainder is a weight exactly proportioned to the weight of mere alkali of that particular species which is contained in one ounce of the substance examined; all beside is superfluous matter.

Crystallised soda.—Though it contains only one-fifth of its weight of real alkali, the remainder being water and fixed air, but the proportion of alkali being invariably the same, it is the fittest for a standard with which other substances containing the same sort of alkali may be compared. Mr. Kirwan found that as much of this substance as would contain 480 grains of mere alkali would precipitate 725 grains of earth of alum dried, and consequently that 480 grains of mere mineral alkali precipitate 725 of earth of alum.

Cunnamara kelp.—This is a hard porous black substance, mixed with white and gray spots, its smell sulphureous, and its taste mixed, being that of common salt and alkali. One ounce of it dissolved in marine acid lost twenty-four grains of its weight, which escaped in an aerial form. This air was hepatic. Another ounce dissolved in boiling water left an insoluble residue, which, being heated in a crucible to redness, weighed 165 grains; this residue effervesced with acids, and seemed for the most part calcareous. This solution precipitated twenty-five grains of earth of alum, and therefore contained 16·5 grains of mere alkali. During the precipitation of the earth of alum much hepatic air was emitted, and the earth was sullied by the sulphur, though only a few grains of this can be presumed to be mixed with it.

Strangford kelp.—This substance was much denser, less porous, and in appearance approached more to that of a vitrified mass than Cunnamara kelp; it was at least equally sulphureous. The solution of one ounce of it precipitated only nine grains of earth of alum, and this earth was much more discolored than that precipitated by the preceding kelp. The insoluble residuum of an ounce amounted to 174 grains.

Vegetable alkali.—Mr. Kirwan found that 480 grains of the purest and driest salt of tartar (making allowance for the quantity of fixed air it contained) precipitated 331·5 grains of earth of alum.

Cashup.—The best sort, namely, that marked with the cross arrows, is of a bluish-gray color, exceedingly hard, and of a semivitrified appearance, its smell sulphureous, its taste scarcely alkaline, and does not attract the moisture of the air. With marine acid, one ounce of it afforded thirty-one grains of hepatic air. When dissolved in water the residuum of an ounce was 357 grains of a gray earth, that appeared to be calcareous for the most part. The solution itself was of a yellow color and strongly sulphureous. With the solution of alum it did not effervesce strongly, until a good deal was added. The precipitate was of a dirty white, and amounted to sixty-six grains, of which two appeared to be sulphur. Hence its quantity of vegetable alkali is nearly ninety-three grains per ounce.

Common Irish weed ashes.—This was of a loose texture, dark gray color, and salt taste, mixed with charcoal, brick-dust, and other impurities. One ounce of it lost by gentle drying forty-seven grains, and in a red heat seventy-two grains more. Twelve ounces of the undried ashes, being lixiviated, left a residuum, which when dried weighed 4214 grains; the solution was reddish, replete with extractive matter; it afforded a large quantity of digestive salt, and some tartar vitriolate, and very little alkali. Two ounces of the same ashes being gently heated to a slight degree of redness lost 186 grains of their weight. One ounce of this calcined ash being boiled in six ounces of water left a residuum of 344 grains, and consequently contained 136 grains of saline matter; but of this saline matter only 22·4 grains were pure alkali, for the solution precipitated 15·5 grains of earth of alum; an hepatic smell was perceived during the precipitation of the alum, and the earth was of a dirty color.

The following table contains the quantity of mere alkali, in 100 avoirdupois pounds of the substances below-mentioned, by the aluminous test:—

	Mineral alkali.
Crystallised soda . . .	20 lbs.
Sweet barilla	24
Cunnamara kelp . . .	3·437
Do. desulphurated by fixed air .	4·457
Strangford kelp	1·25
	Vegetable alkali.
Dantzic pearl-ash . . .	63·33
Clarke's refined ash . . .	26·875
Cashup	19·376
Common raw Irish weed ash .	1·666
Do. slightly calcined . .	4·666

Mr. Kirwan furnishes in his paper a section on the coloring matter of linen yarn and its solvents. Having procured a sufficient quantity of alkaline lie saturated with this coloring matter, or, as the workmen call it, *killed*, and which they are in the habit of throwing away, he found it to be a turbid liquor, of a reddish-brown color, a peculiar taste, and strong smell, affording no sign of either acidity or alkalescence. On five quarts of this liquor he poured two ounces of weak marine acid; there was no effervescence, but a copious deposition instantly took place of a grayish-green color, and the liquor freed from this deposit was of the color of red amber. The next day he drew off the liquor with a syphon, and poured two quarts of pure water on the deposited matter; and, having agitated the whole, suffered this matter again to subside, drew off the water, and added two quarts more; this liquor gave manifest signs of acidity, and continued somewhat reddish. Presuming, that after the addition of so much water, this acidity could not proceed from the small quantity of marine acid he had used, more especially as the liquor originally contained an alkali, in the saturation of which the greater part of the acid must have been employed, he began to suspect that this lie contained an acid of its own, which was disengaged and separated from the alkali by the marine acid as the more powerful of the two; and hence he reserved the two quarts of liquor, last added, for subsequent experiments. After repeated effusions of cold water, when the characters of acidity were scarcely any longer perceptible, he threw the deposited matter on a filter and suffered it to dry for some time; it was then of a dark greenish color, somewhat clammy like moist clay. He took a small portion of it, and added to it sixty times its weight of boiling water, but not a particle of it was dissolved. The remainder was dried in a sand heat; it then assumed a shining black color, became more brittle, but internally remained of a greenish yellow, and weighed an ounce and a half.

By treating eight quarts more of the saturated lie in the same manner, Mr. K. obtained a further quantity of the greenish deposit, on which he made the following experiments: 1st. Having digested a portion of it in rectified spirit of wine, it communicated to it a reddish hue, and was in a great measure dissolved; but by the effusion of distilled water the solution became milky, and a white deposit was gradually formed; the black matter dissolved in the same manner. 2ndly. Neither the green nor the black matter was soluble in oil of turpentine or linseed oil by a long continued digestion. 3dly. The black matter being placed on a red-hot iron, burned with a yellow flame and a black smoke, leaving a coally residuum. 4thly. The green matter being put into the vitriolic, marine, and nitrous acids, communicated a brownish tinge to the two former, and a greenish to the latter, but did not seem in the least diminished.

Hence it appears that the matter extracted by alkalies from linen yarn is a peculiar sort of resin, different from pure resins only by its insolubility in essential oils, and in this respect resembling lacs. He now proceeded to examine the power of the different alkalies on this substance; eight grains of it being digested in a solution of crystallised mineral alkali, saturated in the temperature of 60°, instantly communicated to the solution a dark brown color; two measures (each of which would contain eleven pennyweights of water) did not entirely dissolve this substance. Two measures of the mild vegetable alkali dissolved the whole. One measure of caustic mineral alkali, whose specific gravity was 1·053, dissolved nearly the whole, leaving only a white residuum. One measure of caustic vegetable alkali, whose specific gravity was 1·039, dissolved the whole. One measure of liver of sulphur, whose specific gravity was 1·170, dissolved the whole. One measure of caustic volatile alkali dissolved also a portion of the matter.

M. Hermbstaedt has furnished the following method of preparing colors for dyeing linen goods, which may easily be washed out or bleached and replaced by others. They are much used in Germany, where they are called *waschfarben* or washing colors. The base is a good white starch, which may be combined with any color whatever, in such a manner as to form a compound, that can be dissolved in warm water without being decomposed. But although starch forms the base of all these colors, a particular process is necessary to prepare each of the different coloring matters that are to be combined with it, which we shall give as follows :—

1. *Blue.*—Grind some indigo of Guatimala to an impalpable powder; then pour four ounces of burning oil of vitriol into an earthen pan, and put to it an ounce of the pulverised indigo, by degrees, and always in small quantities; while the indigo is being thus incorporated with the oil of vitriol, the mixture must be well stirred at each fresh addition of the powder with a stone pestle, until the whole liquid mass becomes of a uniform blackish blue color. By thus mixing indigo with oil of vitriol the mixture heats itself, exhales a sulphurous smell, and a slight fermentation will be perceived. As soon as the fermentation ceases, the vessel must be closely covered, and placed for twenty-four hours in a situation moderately warm, in order to give time for the acid to dissolve the indigo entirely.

When the dissolution is effected, the liquid must be diluted with ten times its weight of pure water; after which it is exposed to the fire in a copper vessel, until it is nearly as hot as boiling water. Then soak it in some flocks of wool well bleached, or pieces of white wool, in the proportion of eight ounces of wool to half an ounce of the dissolved indigo; expose the whole for twenty-four hours to a moderate fire of about 150° of Fahrenheit's thermometer. The wool acquires a very deep blue dye, almost black; and the remainder of the liquid is almost entirely deprived of the blue coloring matter, and appears of a dirty green color. In this manner the wool absorbs the blue coloring matter of the indigo, by separating it from the heterogeneous particles that were combined with it.

The wool that has been thus dyed is put into a sieve over a tub, and some pure river water poured on, being kneaded at the same time, until the water comes off quite clear and colorless; thus the heterogeneous and dirty parts are separated from the indigo, and the pure blue coloring matter remains with the wool. When this operation is terminated, a quantity of river or rain water, equal to forty times the weight of the indigo and oil of vitriol, is boiled in a boiler; in this water is dissolved as much crystallised natron as equals the quantity of indigo employed; the dyed wool is then plunged into it, and boiled until it has nearly lost all its color. The wool when it comes out of the boiler is a blue gray; the liquid remains of a fine deep blue, and contains the coloring matter of the indigo pure and dissolved.

If, for instance, an ounce of indigo is dissolved in oil of vitriol, and the liquid evaporated until the weight is reduced to four pounds and a half, then strained through a linen cloth, in order to separate the foreign particles that may be mixed with it, after which, if this blue dye be left to cool, it is then in a proper state to be employed as a coloring matter to give a blue color to starch.

If a deep blue is desired, the proportions must be half an ounce of indigo to a pound of starch; for a middling color, a pound and a half of starch to the same quantity of indigo; and, for a light blue, two pounds of starch to the same. The starch must be put into a bowl, the blue dye poured on it, and the whole well rubbed together until the starch be completely divided, and uniformly combined with the dye. Lastly, the mixture must be left at rest, until it acquires the consistency of a fine thin jelly; it is then dried in a warm air, and put away for use.

2. *To prepare a blue color with prussiate of iron.*—A blue color, similar to the preceding, may be prepared by employing, instead of indigo, prussiate of iron, or Berlin blue. The last mentioned must be of the best quality, and it is rubbed with water in a mortar until it is so far combined with it that it will not easily separate; afterwards the blue matter is left to deposit, the water is decanted off, and the matter is triturated with the quantity of wet starch that is necessary to make the shade of blue desired. This color, which is very fine, is dried, and bears the action of the sun and air better than the preceding. It must be observed, however, that when the cottons that have been dyed with this color are washed with this soap, it always leaves a yellowish tint in the water.

3. *Citron-yellow.*—Weld, saw-wort, and turmeric, are employed in preparing this color. One pound of the two first substances, or half a pound of the turmeric, if that root is preferred, are boiled with twelve pounds of water, in a copper boiler, until the liquid is reduced to a pound, which is then strained through a linen cloth. In this clear liquid two ounces of alum are dissolved, the solution is suffered to cool, and two pounds of white starch are mixed with it, and rubbed until all its particles are well combined with those of the color. This compound is then dried in the air.

4. *Orange color.*—Bixa orellana is preferred for this color: an ounce of it is pulverised with half an ounce of pure potash; some river water is poured on it, and this mixture is digested in an earthen vessel, closely covered, for four hours, at a temperature of 185° of Fahrenheit, and occasionally shaken.

The liquid obtained by this process is of an orange color, which is drained through linen, suffered to cool, and then incorporated with two pounds of starch. The whole is afterwards dried in a warm or temperate air.

5. *Green.*—This color is composed of blue and yellow: in order to obtain it, a part of the indigo dye, described at No. 1, and as much of the yellow dye of No. 3, are mixed together until the desired color is produced, which may be known by trying it on paper. A pound of this mixed dye is dissolved with an ounce of alum; when the solution is cold two pounds of white starch are mixed, and well incorporated with it, after which it is dried.

In this manner different shades of green can be obtained, according to the proportions in which the blue and yellow dyes are mixed.

6. *Olive.*—This color is prepared by mixing the indigo dye No. 1, with the bixa orellana, No. 4, until the desired shade is obtained; the necessary quantity of starch is then added, and the mixture dried.

7. *Red.*—This is prepared from Brasil wood or cochineal; if the first be preferred, a pound of scrapings of this wood must be boiled in a tin copper cauldron, with twelve pounds of rain or river water, until the whole is reduced to two pounds. It is then strained through linen. Afterwards two ounces of alum are dissolved in three ounces of boiling water, to which are added six ounces of the decoction of Brasil wood, and the whole is left to cool. To this mixture three pounds of white starch are added, and well incorporated; then the remainder of the decoction of Brasil wood is poured on, and the mixture is stirred until it acquires the consistency of a thin jelly, when it is dried in the air.

8. *Crimson.*—Half an ounce of pulverised cochineal is tempered with water, and put into a tin vessel, containing two pounds of boiling water. When the whole is well mixed, it must continue gently boiling until the quantity of liquid is reduced to a pound: it is afterwards strained through linen or a paper filter. In this colored liquid half an ounce of alum is dissolved; and when it is cold two pounds of starch are well incorporated with it; it is then left to dry in the air at a mild temperature.

Besides these two colors, other shades of red may be obtained:—

(1.) By adding, instead of the alum, half an ounce of tin dissolved in aqua regia, to a pound of the cochineal or fernambouc dye.

(2.) By mixing either of these dyes with a decoction of weld or turmeric, by which means yellow reds and coquelicot may be produced.

(3.) By mixing them in different proportions with the blue dye, this mixture will produce different shades of violet and purple.

9. *Violet.*—Half a pound of scrapings of logwood must be boiled with six pounds of water in a tin vessel, until the liquid is reduced to a pound and a half. This decoction is strained through linen, or filtered through paper. An ounce of tin dissolved in aqua regia is then added to it, two pounds of starch incorporated with it, and left to dry in mild air. In this manner the colors and shades may be multiplied and diversified in a thousand ways by mixing the above decoction in different proportions, or by adding to it other coloring substances, in order to obtain dyes that may be combined with the starch.

When any of these colors are used to dye wearing apparel, furniture, &c., any quantity may be taken and tempered with fresh water, and afterwards dissolved in boiling water: into this the stuff must be plunged; which, with well rubbing, takes the desired color, and acquires also additional body or solidity.

Mr. Shotwell obtained a patent, in 1807, for a machine for bleaching, washing, and cleansing linen. It consists of an oblong wooden box of about three feet and a half in length, fourteen inches wide, and about fourteen inches deep, made perfectly water-tight, excepting a small hole through the bottom near to one end, to draw off the water when done with, which hole is at other times stopped up by a bung or any other contrivance. To this box legs are affixed, so as to raise it about three feet from the ground; it is covered over with boards laid cross-ways about four inches and a half at each end, and which may be made to project outwards to any extent, as also over each side so as to form a table. The remaining open space is covered with two flaps, excepting a portion of about nine-eighths of an inch; one of these flaps is hung with hinges to the outward or back side, so as to form a door to lift up; the other is simply laid in grooves, and fastened down by wooden bolts. Into the open space between the boards, the washing implement, represented in figs. 6 and 7, is introduced; and to the top of this a lever is attached in the manner shown at B in figs. 8 and 9; though it is evident, the patentee states, that any other mode of propelling the washing implement may be employed, or the lever may be attached in any other way.

Instead of having the washing-implement on the above plan, the box may be entirely covered over with boards, flaps, or doors, as before mentioned; and pieces of wood may be nailed to the inside, so as to form ridges about an inch and a half from the top, on which the washing-implement may be suspended and made to slide; the whole of the upper part will in this case be needless, and the lower part, which will be in the box, is to be affixed to a lengthened piece of wood C, fig. 8, which is to be brought through a hole made in the end of the machine, opposite to that at which the lever B is placed. This lengthened piece of wood is connected with the lever in the manner shown by the dotted lines C D in fig. 8.

The foul linen to be washed by this machine is evidently to be placed on each side of the implement, which is to be forced backwards and forwards by the lever, as before described.

If it be convenient to admit steam into the machine, the water therein will be kept at a proper heat, and the linen will be whiter than in the usual way of washing. The steam may be introduced into the washing-machine by means of a pipe communicating with a boiler.

Fig. 6 exhibits a side view of the washing-implement.

Fig. 7 a front view of the same, or that part which faces the end of the machine.

Fig. 8 is a side view of the apparatus complete. A, the oblong box, with small inclinations at each end, as shown by the dotted lines *a a*, which cause the linen to turn more about than they otherwise would, when the washing-implement approaches them. B shows one way of connecting the lever with the implement, and the dotted lines C D another. E is a mortise to support a tenant board, on which the lever B works; it is more clearly shown in fig. 9 which is an end view.

Mr. Shotwell has constructed another apparatus for the same purpose, which it may be advisable briefly to examine. Instead of making an oblong box, a barrel is formed, which is placed horizontally on axes at each end, which are made to turn in friction-boxes. The barrel is placed on a convenient framing, as may be seen in figs. 10 and 11, to which is generally attached a vessel, immediately under the washing-barrel A, to receive the dirty water from the barrel, in which there is a hole B to permit its escape into the vessel D. In this barrel a hole C is made sufficiently large to put in and take out the linen, &c., and which is stopped up with a bung when in use. On the inside of this barrel one or more ribs is affixed, as in the common horizontal barrel-churn; and when steam is to be employed, as in the apparatus described, it must be introduced through one of the axes, which must be perforated for that purpose: the other axis should also be perforated to permit the escape of any superabundance.

Mr. Weise, of Tooley Street, has taken out a patent for making cloth waterproof. Among the materials enumerated by the patentee are, fur, flax or hemp, carded silk, and feathers. The proportions of these are to be five pounds of the finer furs, two pounds and a half of the wool, two pounds of the flax, one pound of the carded silk, and three-quarters of a pound of the feathers. These materials are to be divided into portions of about two ounces each, and to be passed through a fine carding engine by one portion at a time, the fine fur being first laid or bowed on the roller cloth of the engine, which will cause it to lie on the outside of the carded flake. After being thus carded, the materials are to be drawn, roved, and spun, like cotton, the management directed for them being the same as is used for that substance.

The yarn spun is to be of two sorts, one fine, for the warp, and the other coarser and softer, for the weft. It is then to be woven in a loom of from eight to twelve lambs, and a proportional number of treadles. The fine yarn forming the warp is to be kept at the back of the cloth, and the soft weft in the front, by the means well known to weavers, and similar to those used in weaving diapers and velvets.

When the cloth is wanted to be made waterproof, a composition is to be prepared of equal portions of shell-lac, caoutchouc, mastic, gum animi, and sandarac; by cutting the caoutchouc into very small shreds, and pounding the gums and lac very fine, and then dissolving them in ether and spirits of wine, or spirits of turpentine. Into this composition the fine skeins for the warp are to be dipped, and then to be gently pressed or left to drain, and to be hung up to dry; and, when dry, are to be stretched in the loom, where, instead of the common sizing, the composition above stated is to be used.

After the cloth is woven, the fur or nap is to be drawn forward on its front by teazles or cards, and a hot smoothing iron is to be passed over its back, to cause the composition to sink into it, and close the interstices.

This cloth, when intended for hats, is to be laid over linings or moulds, on hat blocks, of the same materials usual for those of silk hats, and to be managed in the same manner. For wearing apparel the cloth is to be chiefly made of Saxon wool and flax, managed as before mentioned; and when cloth with a pile, like plush or velvet, is wanted, it is to be woven in a velveteen loom, and then to be cut in the usual manner.

A few facts connected with the history of weaving may now be introduced.

The combined arts of spinning and weaving are among the first essentials of civilised society, and we find both to be of very ancient origin. The fabulous story of Penelope's web, and still more the frequent allusions to this art in the sacred writings, tend to show, that the fabrication of cloth from threads, hair, &c., is a very ancient invention. It has, however, like other useful arts, undergone a vast succession of improvements, both as to the preparation of the materials of which cloth is made, and the apparatus necessary in its construction, as well as in the particular modes of operation by the artists. Weaving, when reduced to its original principle, is nothing more than the interlacing of the weft or cross threads into the parallel threads of the warp, so as to tie them together, and form a web or piece of cloth. This art is doubtless more ancient than that of spinning, and the first cloth was what we now call matting, viz. made by weaving together the shreds of the bark, or fibrous parts of plants, or the stalks, such as rushes and straws.

This is still the substitute for cloth amongst most rude and savage nations. When they have advanced a step farther in civilisation than the state of hunters, the skins of animals become scarce, and they require some more artificial substance for clothing, and which they can procure in greater quantities. Nevertheless, some people are still ignorant of the art of weaving; for the cloth made in the islands of the South Sea appears to be made by cementing or glueing the shreds together, rather than by weaving. From the description given by captain Cook, and other circumnavigators, and from the specimens which have been brought to Europe, their cloth, or rather matting, is in general produced by cohesion of the parts, rather than texture. This assimilates it more to the ideas which we attach to paper or paste-board, than those which we form of cloth.

When it was discovered that the delicate and short fibres, which animals and vegetables afford, could be so firmly united together by twisting as to form threads of any required length or strength, the weaving art was placed on a permanent foundation. By the process of spinning, which was very simple in its origin, the weaver is furnished with threads far superior to any natural vegetable fibres in lightness, strength, and flexibility; and he has only to combine them together in the most advantageous manner.

The art of weaving cloth has been so extensively applied in almost every civilised country, and the knowledge of its various branches has been derived from such a variety of sources, that no one person can ever be practically employed in all its branches; and, though every part bears a strong analogy to the rest, yet a minute knowledge of each of these parts can only be acquired by experience and reflection.

We may now briefly examine the origin of the linen manufactory in Ireland. In the year

1633 lord Wentworth, an austere, imperious, but active and sagacious nobleman, entered into office as chief governor. He was a tyrant, but his tyranny was tempered with wisdom. Sensible how much the power and glory of a monarch depend on the prosperity of his people, he was so assiduously attentive to the peace, intellectual improvement, and industry of the Irish, that, though individuals often felt the arrogance of his temper, the nation in general had reason to be grateful for the benefits arising from the vigor of his administration. Protected by a strictness before unknown in the execution of English law, unusual numbers, and with unusual attention, applied their thoughts to pursuits of industry; the consequences of which appeared in the rising value of land, the augmented quantity of products for exportation, and such an increase of commerce, that the shipping of Ireland was multiplied a hundred fold. For the encouragement of traffic, this deputy, so zealous for the promotion of the power and revenue of his master, used his influence for the abolition of oppressive duties on the importation of coals and horses into Ireland, and on the exportation of live cattle.

By Wentworth's endeavours, a manufacture of linen cloth was established in Ulster: a recent fabrication of woollen drapery was discouraged, lest it should come in competition with that of England, for the purpose that Ireland should be dependent on that country for the clothing of its inhabitants, and consequently less prone to a political separation; to make amends for this injustice, the deputy exerted himself so strenuously for the encouragement of linen, that he took a share in the enterprize, at the expense, according to his own statement, of £30,000, from his private fortune; as flax had long been known to thrive in this country, and many of the women being spinners, hopes of success were early conceived. Flax-seed was brought from Holland; weavers from several parts of the Low Countries, and from France; looms were fabricated, and regulations formed for the prevention of defects in the cloth by fraud or negligence: experience has proved the propriety of the plan, since this manufacture, notwithstanding its interruption in its infancy, by a desolating civil war, became in time the principal support of the wealth of Ireland.

In Ireland, every bleacher must stamp his own name on the end of every web; hence it can always be ascertained, by mere inspection, where the bleaching has been performed. Again, should any goods be improperly bleached, so that the texture is injured, the bleacher is liable to be compelled to take back the whole of them, and pay every expense of carriage, however far they may have been conveyed from the spot where they were finished. In this case, the bleacher is also subjected to a considerable fine. So certain is the infliction of this penalty, in case of a complaint being properly lodged against a delinquent, that some years ago, when the bleaching process was not conducted with that care with which it is at present, several persons actually travelled through many of the counties of England and Scotland for the purpose of collecting from the mercers all such damaged Irish linens, and for which they paid good prices, in order to be entitled to receive the fines.

The best regulation may, however, be superseded and often evaded. Accordingly it is well known that many hundred thousands of pieces of calicoes are made and finished in Lancashire, and stiffened in a peculiar way, to imitate the Irish linens, particularly those made at Colerain, and that they have the name of this place stamped upon them.

It is notorious that a kind of linen thread made at Paisley, in Scotland, and known by the name of nuns' thread, has the preference, and is the best for use. In consequence of the character which this thread has acquired, the Irish have begun a similar manufacture, and scruple not to usher theirs into the market under the sanction of a stamp bearing the name of Paisley.

In like manner, an article called Inkle, and some species of thread resembling that which is made in Holland, are now manufactured in large quantities in Scotland, and sold under a Dutch stamp; the method of making these articles having been stolen from Holland, and brought into Scotland half a century ago. Thus, self-interest is apt to be the leading motive with mankind in all nations.

The linen trade of this country is regulated by several statutes.

No person shall put to sale any piece of dowlas linen, &c., unless the just length be expressed thereon, on pain of forfeiting the same, 28 Hen. VIII. cap. 4. Using means whereby linen-cloth shall be made deceitfully incurs a forfeiture of the linen, and a month's imprisonment. Stat. 1 Eliz. cap. 12. Any persons may set up trades for dressing hemp or flax, and making thread for linen-cloth, &c. 15 Car. II. cap. 15.

By 43 Geo. III., c. 69, all former duties on linen-cloth, silks, cottons, and calicoes are repealed; and in lieu thereof other duties are imposed upon all goods which shall be printed, stained, painted, or dyed in Great Britain, according to a schedule annexed to the act: and, by 50 Geo. III. c. 26, certain export duties are imposed; the said duties to be paid by the printer, stainer, painter, or dyer. By 49 Geo. III., c. 98, certain duties and customs are imposed upon French linens (or lawns). By 43 Geo. III., c. 69, every calico printer, and every printer, painter, or stainer of linens, cottons, or stuffs shall pay annually for a license £10. The printing or staining of calicoes must be for exportation; because by 7 Geo. I., stat. 1, c. 7, the use of printed, painted, stained, or dyed calico for wearing apparel is prohibited, on pain of £5 to the informer, on conviction: and a person offering such for sale, unless for exportation, forfeits £20, half to the informer and half to the poor. This prohibition, however, does not extend to calicoes dyed wholly blue: and it shall be lawful to use stuff made of linen yarn and cotton wool manufactured, and printed or painted in Great Britain, provided the warp thereof be wholly linen yarn. 9 Geo. II., c. 4. By 14 Geo. III., c. 72, it is enacted that no greater duty shall be paid for stuffs made of raw cotton wool within this kingdom than 3½*d.* a yard, 43 Geo.

III., c. 69, and that any person may use the same in apparel or otherwise: and every piece is to have three blue stripes in both selvedges, and to be stamped at each end with a stamp provided by the officers of excise; and, instead of the word calico, used for foreign calicoes, each piece shall be marked with the words British Manufactory. If stuffs made wholly of cotton, and printed, painted, stained, or dyed stuffs (muslins, neck-cloths, and fustians excepted), without such mark shall be exposed to sale, they shall be forfeited, and £50 for each piece. If any person shall counterfeit such stamp, or knowingly sell such stuffs with a counterfeit stamp, he shall be guilty of felony without benefit of clergy. If any person shall import any calicoes, muslins, or other stuffs made of linen yarn only, or of linen yarn and cotton wool mixed, or wholly of cotton wool, in which shall be woven in the selvedge any such blue stripe, he shall forfeit the same and £10 for each piece. Every such printer, painter, stainer, or dyer, shall give notice in writing, at the next office, of his name and place of abode, and where he intends to work, on pain of £50. 10 Anne c. 19; 25 Geo. III., c. 72. By 1 Geo. II., stat. 2, c. 34, any person undertaking to print, paint, &c., any silks, linens, or stuffs, at any other place than the place of his usual residence or exercise of his trade, shall first make entry of the place, and pay the duties, on pain of £50, and forfeiture of the goods. Officers may enter at all times, by day or night, to take account, &c., and the penalty of obstructing the officer in the execution of his duty is £200. 10 Anne c. 19; 25 Geo. III., c. 72. Goods shall be entered once in six weeks on oath before the collector or supervisor, on pain of £50. 10 Anne c. 19. No person shall begin to print, stain, paint, or dye any goods before they have been measured and marked, on pain of forfeiting the same, and also £20 for every piece. 25 Geo. III., c. 72. If any printer shall wilfully cut out or deface such frame-mark, he shall forfeit £50. Concealing goods, or avoiding duty, incurs a forfeiture of £50; and all goods found in a place of which no notice has been given, or the value thereof, shall be forfeited. 10 Anne c. 19; 25 Geo. III. c. 72. Nor shall goods be kept in unentered places on pain of forfeiting £50, and the goods. 20 Geo. III., c. 72. Within six weeks the duties shall be cleared, on pain of forfeiting double. 10 Anne c. 19. Nor shall they be removed before the officer has taken account of them and stamped them, on pain of £50, and seizure. 10 Anne c. 19; 25 Geo. III., c. 72. Goods surveyed shall be kept separate from those unsurveyed, on pain of £50; and goods unstamped may be searched for and seized. 10 Anne c. 19: 25 Geo. III., c. 72. The person in whose custody such goods are found shall forfeit £100. 5 Geo. III., c. 11; 27 Geo. III., c. 31.

Calicoes, &c., that shall not have three blue threads in the selvedge, shall be deemed foreign calicoes; and, on being printed or dyed, shall be marked at each end with the words 'foreign calicoes for exportation;' and every dealer who shall have any such goods in his custody (except dyed throughout of one color), or any stuffs made wholly of cotton wool woven in Great Britain, commonly called 'British manufactory,' (muslins, neckcloths, and fustians, excepted), not having such blue threads, shall forfeit £200, and every such piece found in his custody. 25 Geo. III. c. 72. The owner or printer of any piece or remnant of cossac, or foreign muslins and calicoes, shall, before they be presented to the officer, mark the same at both ends with a frame-mark, containing his name and place of abode, and also the name by which such goods are commonly known (except such as are dyed throughout of one color), on pain of forfeiting £10 for every piece or remnant. The owner or printer of any linens or stuffs made of cotton mixed, or wholly of cotton wool woven in Great Britain, called 'British manufactory or muslins,' shall mark the same at both ends (fustians, velvets, velverets, dimities, and other figured stuffs, excepted) with a mark, containing his name and place of abode, and the name and quality of such goods, with the ready-money price thereof, before the same are presented to the officer in order to be printed or dyed, on pain of forfeiture, and seizure, and £20; and, if any such piece be marked at a less price than the real value, the same may be seized and forfeited, and the owner shall forfeit £20. If the frame-mark be defaced, the same shall be renewed on notice; but if any person shall counterfeit or forge any frame-mark, he shall forfeit £100; and, if any person counterfeit the stamp, it is felony without benefit of clergy. 25 Geo. III. c. 72; 27 Geo. III. c. 31. If any person shall knowingly sell any of the goods with a counterfeit stamp, he shall forfeit £100, and stand two hours in the pillory. 10 Anne, c. 19; 13 Geo. III. c. 56; 25 Geo. III. c. 72. By 27 Geo. III. c. 31, if any person shall knowingly sell any such goods with counterfeit stamp, thus intending to defraud his majesty, he shall be guilty of felony without benefit of clergy. Every person who has paid the duties, or bought the goods of any person who has paid the duties, may export the same, and shall be allowed all the duties in drawback, as set forth in 43 Geo. III. c. 69, Sched. C., on conforming to certain prescribed conditions. 25 Geo. III. c. 72; 25 Geo. III. c. 74. By the 4 Geo. III. c. 37, which establishes the corporation of the English Linen Company for making cambrics and lawns, it is enacted that the commissioners of excise, where there shall be a manufactory of cambrics or lawns, or of goods known under that denomination, shall appoint the supervisor or other officer to seal the same, for which they shall have such fee as the commissioners shall appoint; the manufacturer to give notice in writing to the officer of the finishing of every piece, before it is taken out of the loom, who shall seal the same at both ends; on pain that such manufacturer, taking the same out of the loom without having given such notice, and having the same sealed as aforesaid, shall forfeit £5; and every such piece shall be forfeited, and may be seized by any officer of the customs or excise; and the officer, with convenient speed after notice, shall mark and also number each piece; and make entry in writing, in books to be provided at the expense of the manufacturer, of the number set to each piece, the length thereof, and the number of threads in the warp, on pain of £10. If the officer shall mark any not made in England, or after the same is taken out of the looms, he shall forfeit £50 for each piece to him who shall sue, and forfeit his office, and be incapacitated to hold any other office of trust under the crown. If any person shall offer to the officer any bribe, he shall forfeit £50; and if he shall by bribery, or otherwise, prevail upon the officer to commit such offence, he shall forfeit £100, and stand in the pillory two hours. And the officer shall yearly, in the month of June, transmit to the commissioners an account of all goods which he shall have stamped, and a copy of the entries made, on pain of dismission; and he, or his executors, shall deliver up the seals, on demand from the commissioners, on pain of £200. Cambrics and lawns made in England, found unstamped, shall be forfeited, and may be seized by any officer of the customs or excise, and, after condemnation, shall be sold; and every person who shall sell, or expose to sale, or have in his custody for that purpose, any cambrics or lawns made in England, unmarked, shall forfeit £200: such goods not to be sold, or worn in this kingdom, but to be exported, and to be sold only on condition of exportation. Nor shall they be delivered out of the warehouse until bond be given, to the satisfaction of the collector, in double penalty of the goods, that the same shall be exported, and not relanded. To counterfeit the seal appointed by this act, or import any foreign cambrics or lawns having such counterfeit mark thereon, or expose the same to sale, knowing the stamp thereon to be counterfeited, is felony without benefit of clergy. All goods condemned in pursuance of this act, and all pecuniary forfeitures (not otherwise directed), shall be sued for and recovered in any of his majesty's courts, in the name of the attorney-general, or of such officer as aforesaid; and applied, after deduction of charges, half to the king, and half to the officer seizing, informing, or suing, according to the directions of this act. The penalties may be sued for, levied, and mitigated, as by the laws of excise, or in the courts at Westminster; and employed half to the king, and half to him that shall discover, inform, or sue. 10 Anne, c. 19; 24 Geo. II. c. 40; 25 Geo. III. c. 72. All utensils and instruments for printing, painting, staining, or dyeing such goods, in custody of the said person, or any other, shall be liable to all arrears of the duty, and to all penalties concerning the same, in like manner as if such person was the lawful owner. 10 Anne, c. 19; 25 Geo. III. c. 72; 28 Geo. III. c. 37.

A few statistical tables, illustrative of this branch of our manufacture, must conclude our article. We shall commence with an enumeration of

The species and quantities of Foreign Linens imported and exported from Great Britain and Ireland, in the year ending 5th of January, 1826.

	Countries from which Imported.	Plain of Germany, Silesia, &c.	Plain of Russia.	Plain of the Netherlands.	Canvas, Hessen.	Canvas, Packing, or Spruce.	Hinderlands Brown.	Drillings and Pack Duck.	Sail Cloth.	Damask and Diaper of Silesia, &c.	Damask and Diaper of the Netherlands.	Cambrics and French Lawns.	Silesia Lawns.	Sails.	Unrated, Chequered, Striped, &c.	Unrated, not Chequered, Striped, &c.
		Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Yards.	Yards.	Pieces.	Pieces.	Declared Value. £ s. d.	Declared Value. £ s. d.	Declared Value. £ s. d.
Import into Great Britain.	Russia		186,841½			750		2848¼	166					102 11 7		16 1 0
	Sweden													130 13 0		
	Denmark					830								42 5 11		49 2 0
	Prussia	35				637						6		80 8 0		202 2 1
	Germany	37,310	20		67	2,021½	92	51		45,494¾			70¾	51 18 10		185 9 4
	Holland	4514¼		275	109	2,234½				15			75	36 1 10	1 5 0	3 0 0
	Flanders	3445				75					2½			165 0 0	415 11 6	15 9 0
	France	1495		9824½		339½		42		89¾	142	40,297¾			19 16 0	634 5 7
	Jersey	10½	88			67									0 5 0	
	Other countries in Europe	1851½	24½		17					190¾				94 17 0	219 3 9	68 11 0
	East Indies													325 5 0		
	America, &c.					640								179 8 8	0 5 0	8 15 10
	Total into Great Britain	48,661¼	186,974	10,099½	193	7,594½	92	2941¼	166	45,790¼	144½	40,303¾	145¾	1208 9 10	656 6 3	1182 15 10
Import into Ireland.	Russia													32 0 0		
	Prussia													50 0 0		
	Germany															8 0 0
	Holland				55											58 7 8
	France											50½				
	America								17⅙					123 2 10		
	Total into Ireland				55				17⅙			50½		205 2 10		66 7 8
	Total quantities of Foreign Linen imported into the United Kingdom	48,661¼	186,974	10,099½	248	7,594½	92	2941¼	183⅙	45,790¼	144¼	40,354¼	145¾	1413 12 8	656 6 3	1249 3 6

	Countries to which Exported.	Plain of Germany, Silesia, &c.	Plain of Russia.	Plain of the Netherlands.	Canvas, Hessen.	Canvas, Packing or Spruce.	Hinderland's Brown.	Drillings and Pack Duck.	Sail Cloth.	Damask and Diaper of Silesia, &c.	Damask and Diaper of the Netherlands.	Cambrics and French Lawns.	Silesia Lawns.	Sails.	Unrated, Chequered, Striped, &c.	Unrated, not Chequered, Striped, &c.
		Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Ells.	Yards.	Yards.	Pieces.	Pieces.	Declared Value. £. s. d.	Declared Value. £. s. d.	Declared Value. £. s. d.
Export from Great Britain.	Germany	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. . .	217 13 9	. . .
	Holland	. .	16,800	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. . .	. . .	. . .
	France	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. . .	. . .	168 0 0
	Madeira and Canaries	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	5	. .	. . .	. . .	. . .
	Asia	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	7	. .	. . .	. . .	. . .
	Africa	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. . .	. . .	48 0 0
	America, British North American Colonies	. .	. .	. .	. .	. .	. .	. .	. .	74½	. .	241	. .	. . .	. . .	16 15 4
	British West Indies	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	251	. .	. . .	. . .	1 0 0
	Foreign West Indies	. .	9,000	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. . .	. . .	. . .
	Mexico	925	. .	. .	. .	. .	. .	. .	. .	37½	. .	88	. .	. . .	. . .	1 4 0
	Total from Great Britain	925	25,800	. .	. .	. .	. .	. .	. .	112	. .	592	. .	. . .	217 13 9	234 19 4
Export from Ireland.	America, British North American Colonies	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	102 4 7	. . .	. . .
	United States	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	11	. .	. . .	. . .	. . .
	Total from Ireland	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	11	. .	102 4 7	. . .	. . .
	Total Quantities of Foreign Linen exported from the United Kingdom	925	25,800	. .	. .	. .	. .	. .	. .	112	. .	603	. .	102 4 7	217 13 9	234 19 4

An ACCOUNT of the quantity of LINEN CLOTH **of all sorts** exported from GREAT BRITAIN to IRELAND, and to foreign countries, in the year ending 5th of January, 1826; distinguishing British, Irish, and foreign linens.

	To Ireland.		To Foreign Countries.				Total Export.			
	Pieces.	Yards.	Pieces.	Ells.	Yards.	£. s. d.	Pieces.	Ells.	Yards.	£. s. d.
British Linens	. .	132,671	. .	. .	35,991,753	. .	. .	. .	36,124,424	. .
Irish Linens	. .	270,350	. .	. :	13,534,843	. .	. .	. .	13,805,193	. .
Foreign Linens	478	. .	592	26,725	112	452 13 1	1,070	26,725	112	452 13 1
Total	478	403,021	592	26,725	49,526,708	452 13 1	1,070	26,725	49,929,729	452 13 1

The value of the Irish linens will be best seen by an account of the number of yards, with their real and official value, exported from Great Britain and Ireland respectively, in the year ending 5th January, 1826, upon which no bounty was claimed.

Great Britain.			Ireland.			The United Kingdom.		
Quantity.	Official value.	Real or declared value.	Quantity.	Official value.	Real or declared value.	Quantity.	Official value.	Real or declared value.
Yards.	£. s. d.	£. s. d.	Yards.	£. s. d.	£. s. d.	Yards.	£ s. d.	£. s. d.
1,985,319	100,634 13 0	194,687 9 8	433,825	26,696 18 6	50,612 18 4	2,419,144	127,331 11 6	245,480 8 0

The following is an account of the number of yards of linen cloth on which duties of excise have been paid in the year ending 5th of January, 1826, for painting and printing linen cloth respectively, with the rates of duty paid per square yard.

Linen cloth painted at 3½d. per square yard.	Linen cloth printed at 3½d. per square yard.
Yards. 554,721	Yards. 1,378,356