# 19th century textile invention in the West of England

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The great inventions of the industrial revolution as far as the textile trade was concerned came from either the cotton trade or from outside the industry. Neither Lewis Paul or Wyatt, Bourn, Hargreaves, Arkwright or Crompton, Cartwright or the later Roberts, had any connection with the wool textile trade. It almost seemed that the wool textile trade had been making cloth for so long in a fixed way that it could not believe that any improvements could be made. In this respect there does not seem to have been much to choose between Yorkshire and the West of England and, indeed, the West considering its size, did quite as well as its considerably larger rival.

Once the great cotton inventions had been made it was found that the new ideas could easily be adopted for wool. It follows that later inventions to improve methods were mainly involved with those processes that were unique to wool.

It will be convenient to divide the processes into the following sections:

1 Preparatory
2 Yarn making
3 Clothmaking
4 Finishing

and to consider what processes there were which were unique for wool.

**1 Preparatory processes** essentially consist of those concerned with cleaning the wool and can be divided into (a) the wool washing or scouring, and (b) the removal of small pieces of vegetable matter. There was never any question of scouring cotton, so wool had to proceed on its own and the wool scouring machinery which emerged by about 1850 was certainly a somewhat odd version of the old, long-used hand process of stirring the wool with rakes in a bowl. In addition the wool had to be dried. In both these fields a Trowbridge firm, Moores, invented machines which had some success and, later in the nineteenth century, one finds pictures of them reproduced in contemporary text books. They were not greatly different from the machines made in Yorkshire by Petrie and McNaught and one can assume that the Yorkshire machine makers won in the sense of being better known than their West of England competitors because they had a larger market to serve. From the drawings I have seen and my knowledge, gained many years ago of knowing how an old Petrie machine made c 1875 operated, I do not think that they were very much different. Moore's drying machine was better known than their scouring and consisted, as did all others, of having a travelling lattice carrying the wool through a heated chamber.

Most vegetable matter was removed by willowing, a kind of preliminary carding, and the machines in use in the West of England were, as far as I know, all from Yorkshire, and this applied to other machines used for this difficult process. There were several types of these, the first and perhaps better known, a simple kind of willowing machine made by the firm of Sykes in the West Riding and popular in the West of England, where it was known as a ‘bumble’ on account of the noise it made. Then there were the burring machines. Basically these were unsatisfactory as they moved too much wool as well as the attached burr. At the end of the century they were to be largely replaced by carbonising (treatment with sulphuric acid). The idea of crushing the vegetable matter between rollers, used in the worsted trade and mainly based on a continental invention made by Harmel Freres, was not known in the West of England and for that matter, was not used - rather strangely - by the Yorkshire woollen trade.

**2 Yarnmaking** divides into the first half, namely either carding or combing, and then the spinning. As the West of England was almost entirely a woollen yarn producing area, we can confine our attention to carding as far as this first half of the yarnmaking process is concerned. This is perhaps an appropriate place to define woollen and worsted cloth. Woollen yarns and cloths are made from short wool which is carded in preparation for spinning and fulled in the finishing. Worsteds are made from long wool which is combed and the cloth is not fulled in the finishing.

The basic carding machine so quickly adapted for wool from the original cotton, was the main reason for the first stage of the industrial revolution in both Yorkshire and the West of England. As far as the latter was concerned the many small mills that were built in the area c 1790-1800 were based on Bourn’s original invention, to some extent as improved by Arkwright. The great difference between the carding machine used for cotton and that for wool consisted in the fact that on the cotton machine carding took place between the central roller (the swift) and flat cards erected around it. In the woollen machine the flat cards were replaced by rollers. I have not ,as yet, been able to identify who was responsible for this important invention but I see no reason to believe that it came from the West of England. When carding machines increased in size, changing from a single one-part machine to those comprising two or three, it was necessary to have intermittent feeding arrangements between each part. One of the most widely adopted was made in the West of England by a Stroud inventor named Apperley. This firm also registered a number of patents for improving the condensor, which is that part of the carding complex where the web of fibres is converted into continuous slivers. Miss Mann comments: ‘In fact, the machine-making firm of John Apperley of Dudbridge, well known for its very successful patent feeding apparatus, which could be used either for carders or condensers and for which they obtained a medal at the Exhibition of 1862 . . .' (Mann: *The Cloth Industry of the West of England*, p 201 ).

As stated above, there can be no doubt about the success of Apperley's intermediate feed; it is, however, more difficult to decide what the firm's condenser actually achieved. Some commentators seem to have excepted the

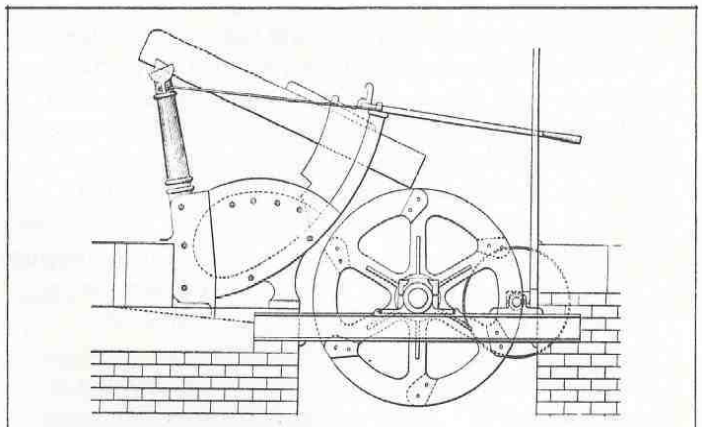
West from the slowness of using the condenser which was basically an American invention, but how far this could have been due to Apperley's work we do not know.
When one turns to spinning the West does not appear to have made any inventions of importance.

**3 Clothmaking** which is basically weaving and therefore involves the loom. There were loom makers in the West, Millars of Trowbridge, for example, but there is no evidence that the looms they made were the equal of those manufactured in the north - not that they were particularly good. The area came to depend towards the end of the century upon the new dobby loom which was a great improvement on what had gone before and enabled them to weave semi-fancy cloths on a good power loom. These looms, like those that solved the problem of condensing, were basically American inventions. So, for that matter, was the so-called automatic loom which changed the weft bobbins in the shuttles without stopping the looms; but because of the limitation they placed on designing, these looms did not find any use in the West until well into the twentieth century.

**4 Finishing** had long been the great traditional craft skill of the West of England and it is not surprising that the main West of England field for improvements came there. There were three important inventions (a) the work of the rotary fulling machine, mainly coming from John Dyer of Trowbridge, (b) the perfecting of the idea of a circular cutter. This idea had originated in America but the first really satisfactory machine was made in Stroud. Lewis of Brimscombe was the best known name but others played a part. This group of inventions are probably the best known contribution of the West to the trade's discoveries during the industrial revolution. However, I would hold that (c) the invention of roll boiling by J C Daniels is the most original of all and in some ways the most important. It heralded quite a new field as it was essentially a chemical/physical improvement, having little or nothing to do with a new machine. In this way it foreshadowed the great chemical/physical discoveries that were to come during the next hundred years.

To consider these three groups in a little more detail:

(a) Fulling had long been done by stocks driven by water power. It must be remembered that this old fulling process combined two operations (i) the scouring or cleaning of the pieces, and (ii) the fulling or thickening and shrinking.

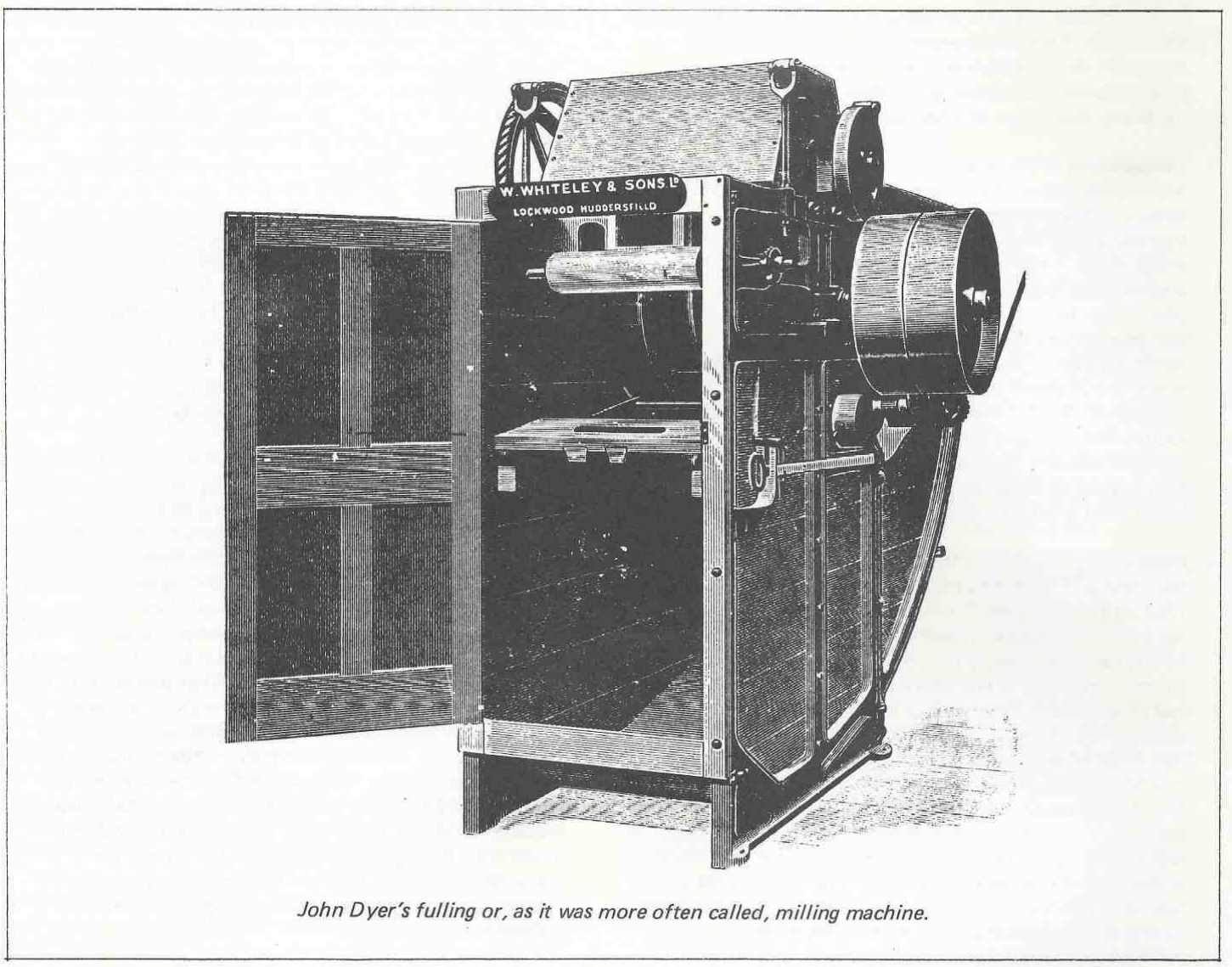


*The traditional fulling stock used in the West of England from about 1300.*

During the early years these were made separate processes and the work that was done on the scouring machine came before and does appear to have influenced the successful adopting of a rotary fulling machine. Gloucestershire seems to have taken the lead in developing this new scouring machine. William Lewis of Brimscombe patented in 1816 a machine consisting of two revolving cylinders through which the cloth passed. This was the basic idea of the machine: 'He claimed that it dispensed altogether with the use of sig (urine) and avoided the partial felting that often occurred in scouring and made burling more difficult afterwards'. (Mann, op cit p 297). This would be the case, and interest in the machine is shown by the number of other patents of Alfred Flint of Uley and William Baylis jnr, of Painswick. This machine was used in the Stroud area well before its adoption in Yorkshire which appeared to have retained the fulling stocks for both processes as late as 1841.

Meanwhile, attempts were made to improve the old stocks but they hardly amounted to anything really new. Circular fulling, although based on the scouring idea mentioned above, was certainly new. The first patent, and indeed the key one, was obtained in 1833 by John Dyer, a Trowbridge engineer. It essentially consisted of adding some measure of compressing the cloth in both the length (warp) and width (weft), so causing the required shrinkage. Dyer sold it the following year and it came into the hands of a man named Chevalier, who also acquired a somewhat similar one taken out in 1841 by Luke Hebert of Birmingham, apparently acting for an inventor abroad. Chevalier was advertising the invention in the *Leeds Mercury* in 1843, and in 1847 advertisements began to appear in Gloucestershire from Robert Wood and Sons of Hunslet, who depicted their machine as 'preferred by most of the finest manufacturers in the West Riding'. Dyer reserved the right to make his machine himself and he must have incorporated into it various additions and improvements, probably made elsewhere.

Turning to (b) circular cutter, the first mention of this idea which was in the end to replace the shears, is in a patent of Samuel Dorr of Albany, USA, taken out by him in 1793 just before his death. (His English patent was " No 1945 9 April 1793, and his death is mentioned in patent No 1985, 7 May 1794). His son did further work but the whole position is rather confusing and it is not easy to decide where the main line of development occurred. There were obviously three separate ones but all probably depended on the original Dorr patent. It is perhaps fair to conclude that the American followers of Dorr did not make great progress towards producing a practical machine but it is more difficult to decide between the work done in France and that done in Gloucestershire. There is also the question of deciding which of the inventors in Gloucestershire contributed most. By far the clearest statement of the position appears in Miss Mann's book and what follows is based on that, combined with some additions based on the writer's own practical experience plus many conversations on the subject with Miss Mann. Lewis's first patent was for a lengthway cutting with a rotary cutter (No 3945, 27 July 1815) and l have always considered that this constituted Lewis's main contribution to the whole concept. Unless one has a cutter the full width of the piece, one will never produce a perpetual cutting machine. There is, however, the question as to how far Lewis achieved success with this




*John Dyer's fulling or, as it was more often called, milling machine.*

idea. He became more famous for his cross cutter, which cut across the cloth from selvedge to selvedge ,which would suggest that there were difficulties with his other type, namely the true perpetual cutter. The problem would presumably have been in obtaining a blade of 100 inches wide that did not 'whip'. Less than a month later a similar patent was taken out by another Stroud engineer, Stephen Price (No 3951, 12 August 1815, minutely described in Rees's *Cyclopaedia* Vol 38 which completely ignores Lewis's patent). It would appear impossible now to decide who really led the way. It is a question of deciding whether to give most credence to Lewis's 16-day lead in getting onto the patent book or Rees's opinion that Price was the key man.

Both these cross cutters achieved some practical success. Hirst: of Leeds, a well known Yorkshire clothier and writer, says they were not satisfactory (see *Gloucester Journal* 26 December 1829) but he is not to be trusted. Indeed, he was most unreliable when describing what was happening in the West of England. The next development came in 1818 when Lewis, with his brother and an engineer, William Davis, took out a second patent said to cut from list to list but which could also be used lengthwise. It is extremely difficult to see how one machine could possibly do both jobs.

I think too much has been made of the argument that the cross cutter was more satisfactory. It is true that a twill weave (as for example, the cassimere) can be cut slightly closer from list to list, ie across the twill, but it is very marginal. In our own family business we cut Venetian twills as close as anybody could ever need on a lengthways machine. I knew one firm in the West of England that still kept the Lewis cross cutter, but they never used it.

There does, however, appear to have been quite another series of cloth shearing inventions. Another patent to cut lengthways had, in fact, been taken out in 1816 by John Collier, an Englishman who had set up as a machine maker in Paris and had introduced some improvements into the American machine which had been taken there in 1812. A H Cole in his excellent *The American Wool Manufacture* p 132, has useful information on this point. Collier obtained a second patent to cut from list to list on the same day as Lewis in 1816 (No 4020,1 May 1816 and No 4195 , 15 January 1818). Anybody interested can get more information regarding this interesting English inventor in J J Hernardingner's *Une Dynastie de mechaniciens anglais en France*: James, John et Juliana Collier, 1791 - 1847' *Rev d'histoire des sciences*, 17 July-September 1964. Hirst again appears on the scene and he set up a machine of this

type in Bristol and invited western clothiers to inspect it. They did not, however, buy it and Collier afterwards offered it on trial to Hirst to use in the West Riding and he subsequently ordered another machine. It is difficult to decide if this machine was ever widely used.

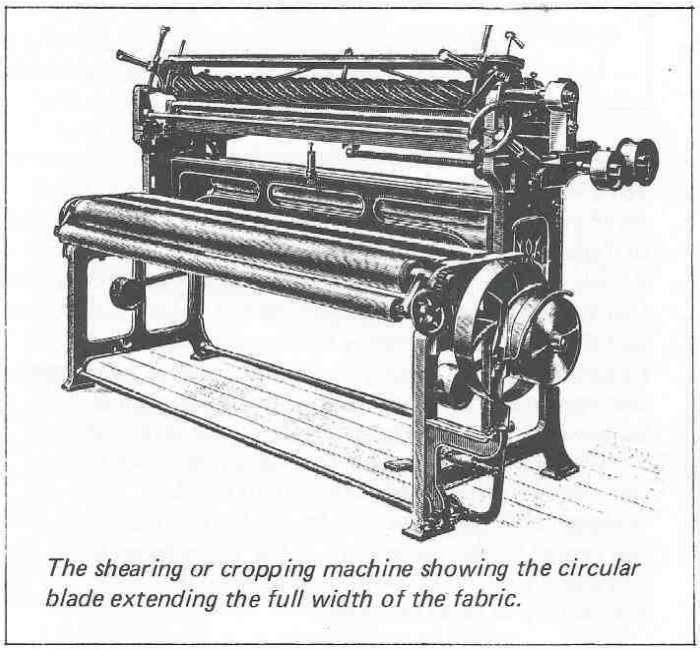
Meantime, back in Gloucestershire: Lewis and his brother bought out Davis's interest in their patents, and Davis himself left Gloucestershire for Leeds. There he appears to have bought up Price's patent, used this machine which he claimed as his own, which, he said, was different from that of Lewis's in several respects. He himself obtained other patents while living in Leeds for processes other than shearing during the years 1825 to 1839. In Yorkshire, in 1823, he was advertising his shearing machine in the *Leeds Mercury* at £420 which he said was half the price of the French one but it is difficult to believe these figures. Collier had also secured a third patent in 1822 and he challenged Davis with having merely copied what he himself had done but his own residence in France appears to have made it difficult for him to carry out satisfactory legal proceedings. Eight of his machines had apparently been imported by 1825 and by that time they were also being made in England. There is considerable information on this point in the *Parliamentary Report Committee on Artisans and Machinery 1824 , 1st report (HC 5 1)*(see p 21 etc). Meanwhile all these machines for a time seem to have been superseded by another machine that had been made in Amiens which was known as the Miles cutter and had been introduced here in 1823. It was patented in England by Thos Miles, clothdresser of Dudbridge who said this was ‘in consequence of communication made to him by certain persons residing abroad’. (Patent No 4799, 3 June 1823). Cole *(op cit)* who is very reliable on inventions, says that Miles was the agent of an Amiens inventor called Bercal Swift.

More generally, I agree with Miss Mann that amongst all these machines it was that of Lewis which made most way in Yorkshire, so much so that in 1831 the only rotary cutters referred to in the *Report of the Committee on Children in Factories* were known simply as 'Lewises'. Upwards of a thousand had been sold. It certainly appears to have been the most successful of the machines and Lewis can be regarded as the key figure.

The Miles cutter had no connection with Lewis but a new Gloucestershire patent obtained in 1824 by Gardner and Herbert, a smith and a carpenter respectively, of Stanley St Leonards, took his machine as a basis for improvement. In 1829 Lewis brought two actions for patent infringement, the first against William Davis a Nailsworth manufacturer, the second against a well-known clothier N S Marling, both of whom were using this machine. Several witnesses gave evidence that the features of Lewis's machine were drawn from various early patents; but the fact that his engineer, also William Davis, had worked for a time with the man who had made the machine in Bermondsey, was only discovered after the trial had ended with a verdict in Lewis's favour.. An application for a new trial failed, a decision which evoked some unfavourable legal comment. Though it was clear that Lewis was not the sole inventor, it was generally agreed that he was the first person in England to produce a machine which cut the cloth effectively from list to list. This, however, does leave open the important question, as to who was really responsible for making a success of the lengthway cutting machine?

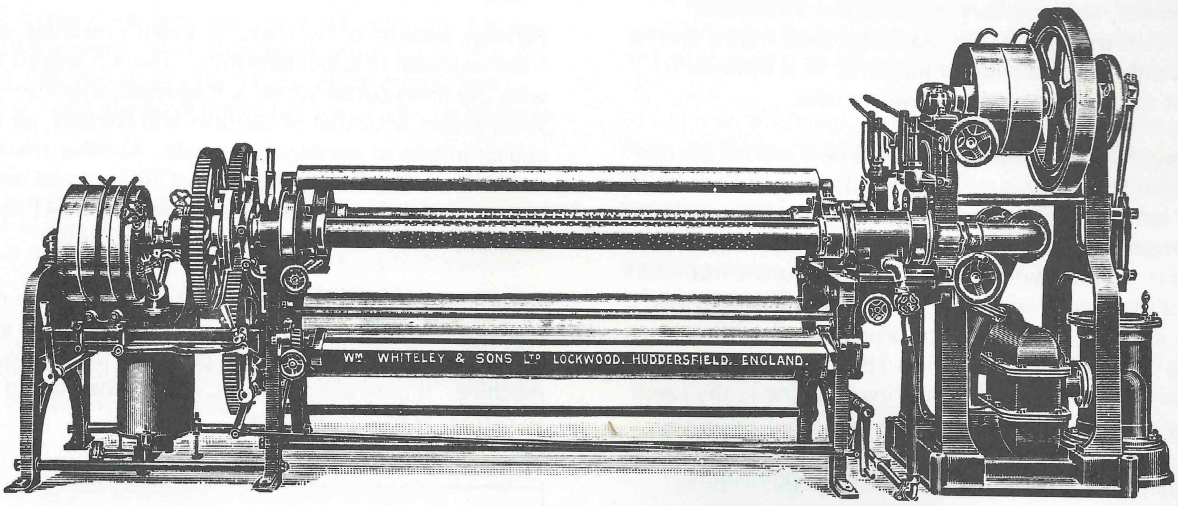
Perhaps, because of his lawsuits, Lewis's machine was far from universal in Gloucestershire. There it shared the field with the Miles cutter which is frequently mentioned, to some extent with that of Gardner and Herbert, all of whom appear in lists of machinery for sale. Another machine was patented by George Oldland of Hillsley and was highly praised in the *Encyclopaedia Britannica* of 1841 but this does not mean that it was all that widely used.

Before turning to Joseph Clisild Daniell, mention must be made of Budding who was a foreman at a Stroud engineering works and adapted the cutting principle to the mowing machine. It does not, however, appear that he did anything to further textile inventions.



*The shearing or cropping machine showing the circular blade extending the full width of the fabric.*

We turn now to (c) Joseph Clisild Daniell, perhaps the most interesting of all the West Country inventors. He was quite definitely the most important inventor of the south, the Wiltshire-Somerset section of the trade. He lived at Limpley Stoke though most of his trading career was spent with the important firm of Charles Wilkins at Twerton, near Bath. Daniell has over twenty textile inventions to his name, two of which are very important. He discovered that if woollen cloth is put into water and boiled for up to twelve hours, the finish becomes more permanent. Daniell was in fact doing the same as is done with the permanent setting of human hair. His invention was brought about in an effort to make the classical dress finish of the West of England broadcloth more permanent. As is well known, this finish was obtained by raising the surface of the cloth with teasles and then cutting it down. Both the processes were done wet and the result was that the surface pile was laid (rather as happens in a billiard cloth today). Unfortunately this could easily be roughed up and Danie|l's patent was aimed on making it more permanent. His process was known as roll boiling and later, potting. The twelve hours’ boiling was the most severe test that any cloth had to stand and only the very best dyes were fast to it. Daniell also argued that his patent gave the cloth a permanent damp-resistant surface but it is not quite clear what he meant by this.




*The decatising (or blowing) machine showing the perforated roller for blowing steam through the cloth. This embodied the same principle as Daniell's roll boiling.*

Although it is not always realised, he did obtain a patent in 1819 for this but the process only became widely known seven years later after he was associated with Charles Wilkins of Twerton, who apparently had been doing similar work . At this time the patent was cancelled, mainly on the grounds that the specification was insufficient but also because it was said the method had already been employed in Yorkshire by a manufacturer as early as 1807 although it was agreed that he had not gone on using it. For this reason and because of the difficulty that there always is in patenting a process rather than a machine, Daniell does not seem to have made further attempts to patent his idea. There can, however, be little doubt that he was the real author of what was one of the key inventions in the series based upon the physical and chemical properties of wool that were later in the century to be so important.

Later, a much simpler and less severe effect could be obtained by blowing steam through the piece either dry or wet. This process was known under a wide variety of names: originally as decatising because of its French origin; as blowing or, when used for a, rather different purpose in worsted finishing, as crabbing. When used for woollens and also for worsteds, at the end of the finishing routine the object was, as with potting, to set the cloth so as to prevent shrinking when the garment was made. When used on worsted cloth before scouring , the setting obtained prevented marks appearing in the cloth due to tensioning problems. The wide use of blowing, to use the more general name, was the main development in wet finishing, indeed in any finishing routine, during the later years of the nineteenth century.

The development of such processes as potting and blowing, like other chemically-based ones, had long term effects which went well beyond the period covered in this essay. The tendency of wool to shrink has both disadvantages and advantages. As far as the latter are concerned it enables the skilled tailor or dressmaker to mould the cloth at the shoulders and elsewhere, the handcraftsman can adjust this treatment according to the fabric he is handling, such care became impossible with the growth of the wholesale making-up industry and the general use of the Hoffman press; this made it much more necessary to be certain that the shrink limits had been included in the cloth by such processes as blowing or decatising.

However, it is perhaps stressing things too far to give Daniell the credit for all these later developments.

Daniell's other invention played a part in the development of roller temples. Ever since weaving first began it had been a problem to keep the cloth at full width in the loom and the handloom weavers used various kinds of temples (as they were called) to achieve this object. The roller temple which consisted of rollers with spikes on them working under a metal cover, was the final successful solution but it is not quite clear how much Daniell contributed. He was certainly not wholly responsible for this very important weaving invention.

Joseph Clisild Daniell was one of the most interesting men in the new woollen trade of the nineteenth century. He has more than 20 patents to his credit, covering all branches of the trade and in addition is mentioned in a number of cloth exhibitions of the time as a designer of novelty fabrics. A quick look at the patents tend to suggest that they were probably bright ideas rather than patents of value but a careful consideration of the few that refer to roll boiling would be a worthwhile study.

Joseph Clisild Daniell is buried in the churchyard at Limpley Stoke and there is a good monument, now unfortunately slightly damaged.

**Acknowledgement**

In preparing this essay, which is a rewritten version of a lecture given to BIAS, l have depended particularly for the section on cropping (or shearing) both on the relevant pages in Dr Julia de Lacy Mann's *The Cloth Industry in the West of England from 1640 to 1880*, and in many talks and discussions with her spread over forty years. May I recommend this outstanding economic history to all interested in the industrial history of the West of England.