

indicated for coarse yarns, and to reduce the number and draught of the drawing heads. One head with a draught of one inch into four inches will probably answer between the rail head and speeders. The middle top rolls of the rail and drawing heads and speeders must be relieved of a portion of their weights. The middle top rolls of the spinning frames must be wholly relieved of their weights, which can be done by substituting single saddles from the front top to the back top rolls for the double saddles generally used, unless the back top rolls are of smooth iron about one and a half inch in diameter, in which case the front rolls may be weighted with a hook and lever weights, and the back rolls be left without weights.

"As cordage and for twines, to which, in the cheaper days of cotton, that substance was extensively applied, hemp and flax still assume their pre-eminence and superiority. Even to the grocer's twine, which must be short and easily broken, these fibres have been extensively and profitably applied. Every variety of twine is now made of flax and tow in several establishments. Thread of the best quality for many purposes is also prepared from this material, and for some branches of the arts it has always been deemed superior to cotton. Coarse linen fabrics of every description, from bagging down through burlaps, crash, duck, diaper, &c., have all been successfully made of flax and hemp, where formerly the greater cheapness of cotton had caused that fibre to supplant its legitimate competitor. In the article of seamless grain-bags, which were formerly made altogether from cotton, we now have a much better article produced from flax. The nicely prepared battings of flax, whether bleached or unbleached, have taken the place, to a great degree, of the application formerly made of the dirty and refuse cotton for this purpose; but the greater weight of the flaxen material depreciates its value and usefulness when to be applied in this way, for a given number of pounds of flax batting will cover a space but half as large as an equal quantity of carded cotton.

"It would not be consistent with the limits of this report to take up the discussion of the whole subject of paper-making, although its main feature depends upon the value of these very fibres we have been examining. As in its production, however, flaxen and hempen fibres may very advantageously be substituted for those of cotton, we may be pardoned for making some allusions to this matter. As before intimated, all of these several fibrous substances are composed of nearly pure cellulose, and thus, in their ultimate composition they are very much alike. It further appears that whatever materials be used for paper-making, their value will depend upon the amount of this proximate principle of cellulose which they contain, and whether the stock consist of solid wood, hollow straw, fresh fibre of bast cells from our flax fields, waste cotton from the factories, or worn-out clothing and old ropes, made from these different fibres, their value in every case depends upon the amount of pure cellulose which can be derived from them. The cellulose from the several sources appears to exist in nearly the same proportions, about fifty per cent., whether we take the wood or the straw for the raw material.

"The union of these fibrous substances in the tissue of paper depends upon a peculiar condition which has been imparted to them by the action of the paper machine, so tearing and breaking the cells and fibrils, and fraying their ends as to give them a sort of felting property—quite different, it is true, from what is described as felting, in another part of this report, but still enabling the ends of the fragments to unite with one another so as to form a tissue of more or less consistency, according to the nature of the materials used.

"An application of flax as a substitute for cotton, which was little expected, presented itself in the formation of hard rolls for print-works and bleacheries. In the construction of these rollers it had been a desideratum to get a hard and elastic surface. This was first accomplished by disks of heavy paper closely applied to one another upon a shaft, firmly compressed and then turned into shape. Next, cotton itself was used; but it is now found that flax fibre may be applied to this object with the most satisfactory results.

"One of the greatest claims which flax presents to our notice is its ability to replace cotton, and with great advantage, too, in all the cases where that substance was formerly used in combination with wool in the production of mixed fabrics. Hempen and flaxen yarns are now resuming their original importance in the manufacture of carpets, both alone and when used as the warp only, of those useful tissues, in which cotton had entered as the leading article."