MODERN MILLING.*

By JAMES NEWBY.

IN looking over the past history of milling methods, from 1850, when the millstone was used, with its one reduction, hopper boy, shoe feed, knockers and reels forty inches in diameter with different grades of cloth, making all the separations on the same reel, and following up the stages to the present time, I see that our advancement is, indeed, wonderful. A miller must be continually on the alert to keep up with the march of progress, or he will awake some fine morning to find his neighbor ahead and his trade gone. Our countrymen are growing more refined in their tastes and are always looking for the best goods on the market.

To hold trade we must make flour uniform in quality; the mill must be kept in perfect order, the rolls, reels and cloths nicely adjusted and frequently looked after, while special attention should be paid to the grain-cleaning department, so often neglected. To produce good flour it is of the utmost importance that we have sound, well cleaned grain of the proper mixture to give the desired results. Upon receiving a load of wheat, note the locality in which it was raised, and the quality, soft or hard. Weigh, and send it to a good machine for separating light materials, then to the weighing hopper and a second cleaner for final purifying before conveying it to the proper bin. The storage system should be so arranged that each grade may be separate, to be drawn from according to the mixture needed in the quality of flour to be made. Having selected such a mixture as is required, run it to the magnetic separator, then to the milling separator, scourer, brush and rolling screen with fan attachment.

We have now arrived at our first reduction. This should be carefully made, as the systems used will control the reductions in the mill. They are three in number, the short, medium and long, all claimed to produce good results. Mine will be for a five to six break on grain, with ten or more on the remainder of the stock. If you have a five-break mill, start with from ten to twelve corrugations per inch, and break down quite hard, so that you may produce ten or twelve drachms of flour and middlings per ounce of break stock. To obtain the best results from breaks, and to equalize the amount of work done by them, I have found it advisable to use a small scale for testing the breaks. It requires a little time to weigh and separate, but it pays. I have, also, a scale for weighing the flour and water used in doughing. After a few trials one can detect very quickly whether the mill is working softer than usual, the wheat changed in quality or the millers grinding closer than they should.

The short system requires simpler bolting methods than the medium or long. This is not because it is short, but because the reduction made is. All the material is soft and the middlings finer and less. Less scalping is required as the grades of stock are less. Gradual reduction means a longer system; the flour made is incidental. The short system disregards the making of middlings to a great extent and presupposes more flour. On the first reduction there are two short systems one retaining the middlings idea, the other rejecting it. The gradual reduction method refrains from making flour until it reaches the fourth, fifth and sixth reductions, making all the middlings possible on the former reductions and begins to make its best flour after it has started on the middlings.

The difference between the systems is: That in the gradual we are not in as great haste to reduce our middlings as in the short. The long produces as large an amount of middlings as possible, the short more flour; the latter, of course, requires fewer separations. The material, also, differs in character: the middlings are fewer and finer. Sizings are but little known, as, in reduction by the short method, they are, practically, done by the breaks. The long system retains the middlings idea and continues purifications and separations. By this plan we have larger germ middlings to be sized and separated. In reducing these germ middlings care should be exercised in having a good separation of the product. The head of this reduction can go to the patent. If it be desirable, the next cut-off may be sent to the reel for dusting, so that the finer middlings may go to the purifier, the cut-off near the tail to the A sizing rolls and the next to the second, the tail going to a duster.

We must have a correct and uniform feed. If it is not, an uneven stock is produced, and low grades are multiplied. Our first rolls were crude in this respect. The most perfect feeding device for breaks is a vibratory apparatus, the stock passing over tables and spreading itself in uniform sheets. It needs very little attention and gives a nicer granulation, with more perfect separations. This is most important, though three-fourths of the millers do not appreciate the fact.

Milling is still in a state of evolution. The systems in use at present will be superseded, I feel assured; rolls will still be used, but great strides will be taken in the handling of the stocks and their purification. As we are getting more perfect dust collectors I think we may soon begin to elevate our stocks with air. I used this method in 1866 with success, in cooling the flour and giving it a better color. Our millers are far ahead of the Europeans, being quicker to see an improvement and to take advantage of it. The period of secrecy in milling is past. The system now in use, of reductions and separations, has been brought to the front and investigated. Practice has given us a good system, though it still leaves much to be desired. In all our reductions and separations we should avoid sending the stock too far in elevators and conveyors, as this wears off particles and produces a soft, pasty flour.

I do not purpose to say which system is preferable. To work any correctly, one must understand all of its points and the mill. It would be folly for the miller to reduce his stock in a long system mill upon the same lines as in a two or three break system. Of course, the use of the former admits of greater skill in the manipulation of separations, while the latter grinds the stock to death as fast as possible.

It is a very easy thing to spoil the good working of a mill by an improper adjustment of the rolls or by neglecting purifiers and separators. Millers sometimes

allow good middlings to get to the end of the mill by not grinding properly, or by not watching all the separations. I would suggest that all millers, when they have nice, clean middlings, should get them into the flour by the shortest route possible. I prefer a finely corrugated roll for this work, as it gives more flour at one reduction and leaves more granular stock for further purification and reduction. Moreover, I make the separations such as to enable me to use about the same numbers of cloth for all of my flours.

It will be impossible for me to fix a definite system of bolting and scalping with the necessary separations as long as we have so many different modes of milling. Whatever system you use, look well to your corrugating; keep the rolls in perfect trim, having the journals fit closely in long bearings, with large pulleys, wide belts and good differentials. Have the rolls dressed often, and, with an attentive miller, you cannot go far astray. Never allow him to run the rolls so as to flake the stock; always grind so that you can feel its granular condition, which should be lively. Bolt and separate freely, as by this means we obtain a better body to the flour. This holds good throughout the mill. If you are running on the middlings idea, I would use the saw tooth corrugation back to back on the first reduction; on the second, the saw tooth running sharp to sharp; on the third, a compromise, the saw tooth on one roll and a corrugation between a round and a sharp on the other. This reduction is as far as I draw good middlings for the first purifier for the best grades of flour. The remainder of the reductions are made by saw tooth rolls running back to back. The rolls should have a good motion, with a differential of two and a half or three to one. After the separations are made, before blending the grades, I would recommend that the flour be run through air currents to cool and bleach it. The successful miller is a man of broad views and advanced thought. He does not cling to old ideas of separations, neither does he adopt all the new wrinkles. He looks about him, reads, investigates and compares. As I have said, we are in a progressive age, and the profitable way is to keep up with the procession.

BLEACHING COTTON YARN.

THE cotton, which should not be previously soaked, is tied in bundles to chains and is introduced into the wooden or iron caldrons; it is placed round the upper and overflow pipes in the center of the vessel, covered with packing canvas, and heavily weighted so as to prevent the chains from being carried upward when the water is put in; this is done from the top, and enough cold or, what is better, warm water is admitted to cover the yarn. While this is being done, soda is dissolved in hot water, in the quantity desired, and run through a linen filter suspended over the caldron on to the yarn, any impurities in the soda being intercepted by the linen.

For every 1,680 pounds of cotton there are used 84 pounds of calcined soda (82 per cent.), or 71 pounds of ammoniate of soda (98 per cent.), or 189 pounds of crystallized soda (37 per cent.), or 50 pounds of hard caustic soda, sometimes called the hydrate of soda. It is not desirable to use a smaller quantity; too weak bucking would involve the use of too strong chlorine later, which would be a source of danger to the yarn, and cannot take the place of boiling under proper conditions. It is evident that caustic soda is at once more powerful and more rapid in its action than carbonate of sodium, while it immediately saponifies the cotton oil which is present in the yarn. Still, many a bleacher has an unreasonable aversion to hydrate of soda, because he fears that it may attack the cotton threads.

Danger to the strength of the thread need not be considered (and it is a matter of indifference whether caustic soda or carbonate is used) until the oxygen of the air acts on the yarns, which have absorbed the alkaline fluid; that is to say, when there is not water enough in the caldron to guard them from contact with the air. If it gets at the hot yarns in the upper part of the caldron during the boiling, or after the boiling while the water is still hot, the oxygen attacks the fiber and weakens the thread, in consequence of the formation of oxycellulose. It is well to see that there is enough water in the caldron before closing it, and, if necessary, to let more in until the yarns are covered to a depth of from 8 to 12 inches of the bucking fluid, so that they are lying in about 2,100 quarts of 2° Bé.—a strong alkaline bath, which, with its 2°, is in complete accord by great good luck with the proportions of weight and mass above given.

When the vat is closed the steam rushes in freely under its bath bottom, the bucking fluid becomes warm, rises high in the overflow pipe, begins to boil, circulates through the yarns from the top downward, and pours over them a continuous flow of fresh, boiling liquid from a point close to the lid, over the upper pipe throughout the vessel. The time allowed for the real boiling is taken from the moment the liquor begins to boil. In wooden vats, nine to ten hours are given; in iron caldrons, with steam pressure five to six hours are given. In both cases the exclusive use of caustic soda admits of the shortening of the time of boiling by from an hour and a half to three hours.

It is of the greatest importance that the yarns should remain overnight in the hot bucking fluid, although it is not kept at boiling point: on the following morning hot, and then cold, water is run through them in the tank itself. Even that washing is not enough; the yarns must be washed clean in running water, or washed by hand in a trough, or passed through a yarn washing machine, or slightly pulled in the hammer-fulling machine. They are then passed through the hydro-extractor to be wrung out, for it is only in the smallest business that the wooden peg can take its place.

The 1,680 pounds of boiled yarn are divided into four parts, when the chains are undone, in order that they may be put, bundle by bundle, into a dilute solution of chloride of lime in four wooden or other reservoirs. Such a quantity as 1,680 pounds of yarn requires on an average 52 pounds of powder of chloride of lime, which contains 25 per cent. in weight of chlorine. The state of the chloride of lime differs considerably, as is well known, depending on where it is manufactured, on its strength, and on the care with which it is looked after in the bleaching store room. The day before the chloride of lime is used it should be put in a reservoir

of masonry of about a cubic meter in extent, carefully stirred up with water, or, what would be better, dissolved with the mixing sieve machine, and diluted with just enough water to make the solution indicate about 3° Bé. after it has been allowed to clear. With that as the starting point, the four chloride of lime baths are arranged to vary between 0.3 and 0.7° Bé., depending on the number of the yarns which are to be bleached.

The determination, according to the degree on the hydrostatical balance, is by no means all that is required for the intelligent carrying on of the business, and for the reason that fresh chloride of lime baths are not always employed; but very often a solution of greater strength is used when it is not desired to waste chloride of lime. As a matter of fact, the chloride of lime bath is only half used up by the yarns that have been in it, and by the addition of a fresh solution it is soon got in order for the next lot of yarn. Keeping that object in view, it is indispensable that not only the chloride of lime solution, but the bleaching baths prepared with it, should be tested before use, not with the hydrostatical balance alone, but also by titration, to ascertain the amount of chlorine present.

The most popular and also the handiest way of making this test is with arsenious acid and sodium, using sulphuric acid and indigo as indicator. When the quality of the fluid has been established by an expert chemist, the test can easily be learned and applied by an intelligent workman. A detailed description of this process of titration is superfluous, as it can be found in any good text book of chemistry.

The chlorine bath for each of the four lots of yarn consists of about 3,600 quarts of fluid, with the required amounts of chlorine for the respective numbers of threads. The yarns are sorted into lots and then lightly thrown into the bath, bundle by bundle, so that they nowhere press on each other, and the fluid has undisturbed access to each bundle. They are left lying in the chloride of lime at least 4 to 5 hours, but oftenest overnight, whereupon the fluid is pumped out of the chloride of lime reservoirs into empty reservoirs; but the cotton, after being left some time in the reservoir for the fluid to drain off from it, is taken out and thrown direct into the acid. Considering the weakness of the chloride of lime baths, another water before the acids is not desirable, either for the workmen or for the cotton threads.

The chloride of lime bath must be clear and transparent. Should the chloride contain too much hydroxide of calcium, or should the yarns not have washed clean after the boiling in carbonate of sodium solution, the chlorine bath becomes cloudy, and it must be made clear before use. A little sulphuric acid sets this right. Many bleachers overdo this acid addition in order to make the solution more effectual, but in so doing they are entering on a dangerous path, which, in the writer's opinion, gives a poor prospect of success.

A number of experiments on a small scale have made it clear that the addition of sulphuric acid to increase a chlorine bath which, it must be understood, is still further weakened by water, uniting the chlorine bath with the acid bath in order to save the special acid bath, has led to a negative result. As long as the yarns remained in the chloride of lime bath with a sufficient amount of the misplaced sulphuric acid, they were a splendid glittering white in the greenish liquid. But as soon as they were taken out and rinsed in water, they soon assumed a sort of yellow color, which became yellower still the more acid was added to the chloride of lime bath, without the threads being weakened, however. This astonishing fact can only be explained on the supposition that the thread in the acid reaction of the fluid shuts itself up, and so it is bleached only on the surface; then on being washed in water, with the disappearance of the acid reaction, it opens itself out, and the inner and unbleached portion of the yarn comes in sight, while the ordinary weak alkaline chloride of lime bath seems to act in opening the cotton thread, and to give the chloride of lime free access to the inside of the yarn.

The four lots of yarn require, together, thirty-three pounds of sulphuric acid of 66° Bé. (with 98.5 per cent. H₂SO₄), which is divided between four vats equally, in about 2,800 quarts of water. The yarns are then lightly thrown into this diluted acid. They are left there four hours; then the acid bath is drained off. They are softened three times in the acid vat with water containing soda, and then washed clean in running water in the trough, or by the washing machine. While it is impossible to establish any proportion between the expense and the danger which the usually weak acid bath with each successive lot of yarns incurs in having considerable additions of chlorine, it is recommended, in the interest of the yarn, that the acid once used should be run off and not used again, as is done in the continuous bleaching of piece goods. If the washing is done in the trough, it is well to throw in a little anti-chlorine or spirits of sal ammoniac from time to time.

The perfectly clean washed bundle is next given a blue tint in an ultramarine water. The nicest blue is produced when the yarns are got into the blue water completely free from acid. Otherwise they are apt to be gray and cloudy in coloring. The ultramarine blue must be carefully mixed with water, well distributed through the water, and bolted through a fine cloth before being put in the blue trough. After having been given the bluetint, the yarns are dried in the centrifugal drying machine—when the weather is fine in the open; when it is unfavorable, a warm drying room is had recourse to, or they are dried on the yarn drying machine, packed and sent to the yarn press.—*Kielmeyer, Deutsche Faerber-Zeitung; Textile Record.*

ORNAMENTING OF WATERPROOF FABRICS.

ANY suitable woven fabric is coated with India rubber proofing, and is then covered or partially covered, according to the design and effect it is intended to obtain or produce, with spun or twisted threads formed of any desired fiber, as silk, cotton, etc. These threads must be laid more or less closely to and parallel with one another in straight lines lengthwise of the fabric, or they may be arranged so as to form stripes, or zigzag lines, or in any other manner to pro-

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