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"Roller-Mills, and Milling as Practised in Budapest."¹

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THE demand for fine pure wheaten flour, free from the admixture of the external husk and coatings of the grain, has led to a series of changes which amount to a revolution in the process of milling.

The old system of subjecting the grain to the action of a heavy revolving millstone was a rough-and-ready way enough of reducing the whole to powder, but it was fatal alike to both the quality and the colour of the product, as, after being so dealt with, the subsequent separation of the finely ground bran from the flour is a physical impossibility. To obtain, therefore, the pure wheaten flour free from the admixture of particles of the external coating of the grain, an entirely different manipulation became necessary, and, amongst other plans tried, was subjecting the grain to the action of revolving fluted rollers.

Experiments in this direction were made so far back as the early years of this century, and the roller-mill was probably first brought into practical shape and used in Switzerland about the year 1820.

In the year 1839 was founded the first roller-mill in Hungary,² the "Josef Walzmühle," named after the Archduke Josef, who was then Prince Palatin. This mill was designed by Mr. Fehr, a Swiss engineer, and comprised thirty-six roller-mills, with which it was intended to accomplish the whole work of reduction and grinding.

Subsequent experience, however, taught that although the roller-mills were well adapted for the process of schroting or granulating the wheat, and facilitating the elimination of the husk, &c., the latter process of reducing the schrot, or grits, or coarse middlings, to flour, could be much better performed by the ample rubbing surface of the millstone; and eight pairs of stones were subsequently added to the mill machinery. This mill afterwards passed into the hands of a company, and became known as

¹ The discussion upon this Paper was taken together with that upon the two preceding ones.

² This mill formed the germ of the present extensive milling industry of Budapest, the projector being Graf Szechenyi Istvan, who projected the Danube Steam Navigation Company, the erection of the iron suspension-bridge between Buda and Pest, &c.

the "Pester Walzmühle," and under the present directorate sixty-four roller-mills and several pairs of stones were added some years since. The original rollers (manufactured in Switzerland) are still at work, however, and doing good service; they are much smaller and shorter than what are now manufactured, being only 6 inches long and 5 inches in diameter. They are driven direct from the main shaft through the medium of spur-gear, a plan now altogether abandoned for the usual belt with fast and loose pulley.

In the course of the last thirty years thirteen other large mills have been erected in Budapest; they employ an aggregate HP. of about 9,000, and are now all milling on the same principle as the Walzmühle, although several of them were originally constructed for carrying out the gradual reduction system by means of stones alone. It was found, however, in all cases that the result was inferior to that obtained with the assistance of the roller mills in the Walzmühle, and within the last ten years all have been reconstructed and roller mills added.

As the result, therefore, of about fifty years' experience in Budapest, the position and function of the roller-mill in the modern system of milling has been pretty clearly defined; namely, for the preliminary processes of granulating (*Schroting*)¹ the comparatively coarsely-grooved, chilled cast-iron rollers; for the further separating (*Auflösung*),² either quite smooth or finely-fluted rollers furnish the best means of dealing with wheat, when it is desired to eliminate the whole of the external coatings of the grain from the products of the meal-containing kernel.

For the later reduction of the fine middlings to the desired degree of fineness, nothing has been found to surpass the millstone.

The excellence of the roller-mill does not therefore consist in its superior grinding capacity, but in its suitability for releasing the kernel of the grain from its external husk and envelope, and permitting of the ultimate entire separation of this latter from the former. It will be seen that in the earlier operation with the rolls the production of meal is purposely avoided, their function being only to break and granulate. Although it is undoubtedly possible to finish the flour with rollers alone, it has been found better, and is now the invariable practice, in all large mills, to employ stones for this purpose. Thus, in the new system of milling the roller-mills and stones each form the complement of the other.

With regard to the desirability and economy of effecting the

¹ *Schroten*—literally to break, bruise or granulate.

² *Auflösung*—literally loosening or dissolution: the process consists in separating small portions of bran which may be still adhering to the fine middlings.

complete separation of the mealy portion of wheaten grain from its external coating, although this latter undoubtedly contains a considerable amount of nutriment, still it is in such a form as not to be readily assimilated by the human system, and therefore it is better to eliminate it entirely from that portion of the produce which is intended for human food, and to appropriate it to other uses. It is an undoubted fact that the freer a sample of flour is from this extraneous matter the higher is its commercial value.

The system of milling adopted in all the large mills in Budapest has for its object the obtaining from any given quantity of grain the maximum amount of fine white flour, and the increasing demand for the article, and the commercial success which has attended the costly and laborious efforts to produce it, must be taken as a sufficient proof that the end justifies the means. From 8 to 10 per cent. more of superior flour is obtainable by this system over the best arrangements of "*Hochmüllerei*," or high grinding with stones.

Wherever this result is aimed at on a scale of any magnitude, although the manipulation may vary in detail according to local circumstances and the peculiarity of the wheat to be operated on, yet the broad principle remains the same, and necessitates five or six times granulating between fluted rollers, and the passing of the produce from each "break" through a system of sorting and dressing machines; further, from twice to four times "*Auflösung*" between either quite smooth or very finely fluted rollers, the produce being carefully sorted and dressed as before, after each operation; and lastly, the passing of the pure middlings and meal between stones, and the final dressing.

The whole manipulation is arranged so as to require a minimum of manual labour, and the passing of the various products in the required direction is arranged automatically by means of elevators and conveyors.

In a large mill the method of procedure is about as follows (Fig. 3, p. 237):—the wheat, after being thoroughly cleaned, is delivered to the first roller-mill *a*,¹ after passing through which it is conveyed into the first sorting cylinder *g*; the portion passing through the mesh of this cylinder is conveyed to the first meal-sorting cylinder *n*, and the "tailings" (or produce which is too coarse to pass through, and must therefore go out at the end) conveyed to the second roller-mill *b*.

¹ Each of these granulating mills has fluted rollers; the flutings vary in degrees of coarseness, each succeeding pair being finer than the preceding one and set closer together. The flutings are not parallel with the axis but spiral.

FIG. 3.—METHOD OF MILLING IN LARGE MILLS.

The produce of this mill goes to the second corn-sorting¹ cylinder *h*, the portion passing through the mesh is conveyed to the second meal-sorting cylinder *o*, and the tailings to the third roller-mill *c*.

The produce of this mill goes to the third corn-sorter *i*, that portion passing through the mesh goes to the third meal-sorter *p*, and the tailings to the fourth roller mill *d*. From *d* the product passes to the fourth corn-sorter *k*, that portion passing through the mesh goes to the fourth meal-sorter *q*, and the tailings to the fifth roller-mill *e*. The produce of *e* goes to the fifth corn-sorter *l*, that portion passing through the mesh goes to the fifth meal-sorter *r*, and the tailings to the sixth roller-mill *f*. Finally, the produce of this mill is conveyed to the sixth corn-sorter *m*, that portion passing the mesh is sacked as flour; the tailings go to the bran-cylinder *s*, and that portion which passes through the mesh of this cylinder is conveyed for grinding out to the stones L. The tailings from the bran-cylinder are passed on to the stones K.

Now, following the course of the produce through the meal-sorters *n*, *o*, *p*, *q*, *r*, the portion falling through the mesh of the first partition of *n* is here caught and removed as low-grade dark flour, from the other partition, the produce is taken and ground for inferior flour by the stones L. The portion of the produce passing through the last partitions of the second, third, and fourth corn-sorters *h*, *i*, *k* are fine middlings, and pass into the middlings-sorting cylinder *v* and *w*. The produce passing through the mesh of the second meal-sorter *o* is sacked as flour, the tailings pass into the cylinders *t*, and that portion passing through the mesh of *t* is conveyed into the dressing machine *y*, the tailings from *t* go into the sorting cylinder *v*. The produce passing through the mesh of the third meal-sorter *p* is sacked as flour, and the tailings are passed into the cylinder *t*. The produce passing through the mesh of the fourth meal-sorter *q* is sacked as flour, and the tailings are conveyed into the sorting cylinder *u*. The produce passing through the mesh of *u* goes to the dressing machine *y*, and the tailings into the sorting cylinder *w*. The produce passing through the mesh of the meal-sorter *r* is sacked as flour, and the tailings are passed into the cylinder *u*; the tailings from the cylinders *v* and *w* are conveyed back to the fourth roller-mill *d*, and come again into the same course of manipulation. The "*Gries*" or grits from the sorting cylinder *v* are passed into the dressing machine *z*, and those from the sorting cylinder *w* to the dressing machine *z* 2.

¹ Corn is to be understood as the broken wheat or "schrot."

All the various grades of fine middlings have their special dressing machines, with different sizes of mesh; these machines are, however, so connected with each other that the produce is passed to and fro until it finds the mesh which is adapted for it. The coarser-dressed middlings of the dressing machine *z* are conveyed to the smooth roller-mills A and B, the finer dressed middlings of the dressing machines *z* 2 to the millstones M and N, or in case it is desired to make a further reduction to the smooth rollers C and D.

The produce of the first smooth rollers A and B is conveyed to the dressing machines E and E 2; the portion passing through the mesh is sacked as flour, and the tailings passed on to the cylinder H. The produce escaping through the mesh of this cylinder H is conveyed to the stones M and N, and the tailings go to the dressing machine *y*, and the dressed produce from *y* to the smooth rollers C D. Thence the produce is conveyed to the dressing machines F and G, the portion passing through the mesh is sacked as flour and the tailings passed into the cylinder I. The produce passing through the mesh of cylinder I is conveyed to the stones M and N, and the tailings to the dressing machines *y*, and afterwards back again to the smooth rollers C D. The stones again have their special sorting apparatus; the produce passes from these (M and N) into the meal-sorter Q; the portion passing through the mesh is sacked as flour, and the tailings go to the meal-sorter S; the portion passing through the mesh of S goes back again to the stones M N, and the tailings to the stone L for grinding out. The product of the stone L goes to the meal-sorter P, the portion passing through the mesh is sacked as flour, and the tailings are passed again through the stones. The produce of the stone K is passed into the meal cylinder O, the portion passing through the mesh being sacked as flour, and the tailings (which are bran) being passed into the bran-cylinder R. The tailings from R are clean bran, and what passes through the mesh is conveyed to the stone L to be fully ground out.

The above method of milling is adapted for producing highly-refined flour in large quantities. In some of the mills at Budapest, however, the reduction and sorting are carried out to a still higher degree, and instead of two reductions with smooth rollers four or more are completed.

The Paper is accompanied by a diagram, from which the wood-cut has been prepared.

[DISCUSSION.