LABORATORY MILLING
I. A Small-Scale Bran Finisher[1]

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ABSTRACT

A small bran finisher is described for reclaiming from bran the 1 to 3% of flour normally lost in laboratory milling. Total flour may thus be increased to approximate the yield obtained in commercial milling.

In assessing the quality of wheat samples it is often useful to obtain a yield of flour approximating that obtained in commercial practice. One reason for the lower yield usually obtained in laboratory milling is that no provision is made for reclaiming flour from the bran and shorts, whereas bran finishers and shorts dusters are normal components of commercial milling equipment.

A small-scale bran finisher has recently been built in this laboratory. It is described in this paper, and examples of results obtained with it are presented.

General Description

Figure 1 shows a photograph of the equipment. Exterior dimensions of the finisher are 32¼ by 24 by 10 in., and its weight is 143 lb. The housing is constructed from ¼-in. 24 S.T. aluminum panels, butted together and joined with ½-in. self-tapping screws. These panels were given an engine finish on the outside surfaces. A Plexi-

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glas door, hinged to the cabinet, permits the operator to view stock passing through the screen, and gives access for cleaning. The complete unit is mounted on a 24-in. welded angle-iron base equipped with four casters. It is so constructed that it may be readily dismantled and reassembled should repairs or modifications be necessary.

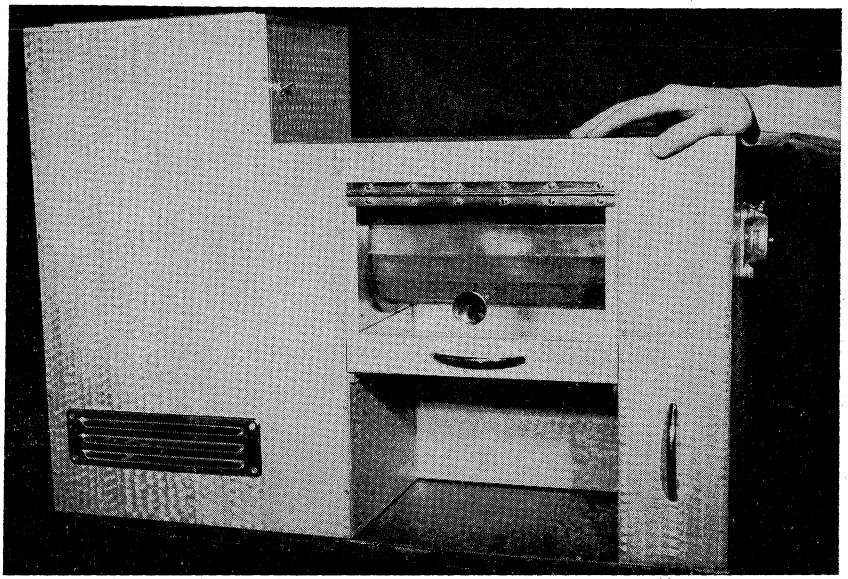

Fig. 1. Photograph of bran finisher.

Description of Principal Parts

Figure 2 is a drawing of the exposed front and end views of the machine. The taller section, on the left in the front view, houses: a feed hopper, *A*, 6½ in. deep and tapered from 12 by 9½ in. to 6¾ by ¾ in.; a ¾ in. feed worm, *B*; a variable pitch pulley, *C*, mounted on the main shaft; and a double-shafted ⅓-h.p. motor, *D*, which drives both the feed worm and the main shaft. The remaining section contains a prefeeding chamber, *E*, of circular cross-section 6 in. in diameter and 3 in. long, and an extraction chamber, *F*, 12 in. long. A four-bladed reel, *G*, 15 in. long, rotates within the prefeeding and extraction chambers. The rotor blades are 15 in. long, 1½ in. wide, and ⅛ in. thick. The outer edge of each blade is cut into teeth 1 in. long, and each tooth is divided by a ⅛-in. slot ½ in. deep. Each tooth is offset 10 degrees, which produces a spiral centrifugal action to the stock and carries it through the machine. Set

screws, *H*, permit the diameter of the reel to be adjusted up to 6 in. The reel is mounted on a ¾-in. shaft, *I*, in two self-aligning flange ball-bearing units, and is driven at 1500 r.p.m. The feed worm is driven at 425 r.p.m.

Extracted flour is collected in a drawer, *J*, below the extraction chamber, and the bran continues to the tail end of the machine,

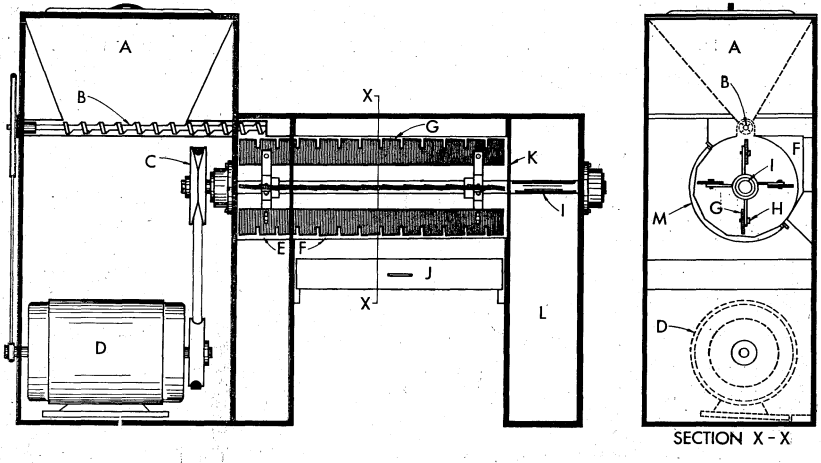

Fig. 2. Drawings of front and end views with plates removed to show interior detail.

where it is collected in another drawer, *L*. A baffle, *K*, is placed on the end of the extraction chamber to control the bran as it passes into the drawer.

The end view, on the right, shows additional details of the extraction chamber and the reel. The extraction chamber is a continuation of the circular prefeeding chamber, but is extended and offset 90°, making a flat wall on the back of the chamber. This breaks the motion of the stock and prevents it from traveling at the same speed as the rotor. As the stock is rotated and thrown against this wall, the impact aids in removing some of the adhering flour; in this respect, the laboratory machine is similar to the Buhler Impact Finisher. The front portion of the extraction chamber comprises a perforated metal screen, *M*, with holes 1 mm. in diameter, mounted on a removable frame. The surface of this screen is divided into six flats, which improves its efficiency in removing flour from the bran. The screen may be replaced with others of different mesh should this be required. Also shown in the drawing are the shaft, *I*, adjusting screws, *H*, and motor, *D*, all of which were previously described.

Operation

Bran is introduced into the feed hopper, *A*, and is carried by the feed worm, *B*, into the prefeeding chamber, *E*, where it gains momentum before entering the extraction chamber, *F*. From the extraction chamber, flour is expelled into the drawer, *J*, and bran continues through the machine and is collected in the drawer, *L*.

The bran is usually passed twice through the machine. A sample of 350 g. of bran, obtained by milling 2,000 g. of wheat, passes through the machine in approximately 1.5 minutes. There is little damage to the bran, so that contamination of the flour by bran powder is not excessive.

Typical Results

To illustrate the effectiveness of the equipment in reclaiming additional flour, examples representing two hard and two soft wheats are reported in Table I. Each wheat was a composite of its respective class. They were milled to yield on an Allis-Chalmers laboratory mill (three sets of corrugated and one set of frosted rolls), and the bran put through the finisher. Experience with a large number and wide range of samples shows that the amount of flour recovered from hard wheats is of the order of 1.2 to 2.0%, whereas about 3% or more is generally recovered from the bran of soft wheats. It should be mentioned that the mill is adjusted for hard wheats and tends to give lower yields from soft wheats than could be obtained by suitable readjustment of the mill.

Data in Table II show typical results for laboratory milling of No. 2 Manitoba Northern. A number of replicate millings were made with the Allis-Chalmers mill in order to accumulate sufficient bran-finisher flour for analytical and baking tests. The flour obtained from the mill, from the bran finisher, and from the two combined in accordance with the extraction rates, were analyzed, and were baked

TABLE I

EXAMPLES SHOWING FLOUR EXTRACTION, ASH, AND COLOR, FROM DIFFERENT CLASSES OF WHEAT

PROPERTY	HARD RED SPRING	HARD RED WINTER	RED WINTER	SOFT WHITE SPRING
Bushel weight, lb.	64.0	64.5	62.0	64.8
1000-kernel weight, g.	32.4	28.1	29.8	36.4
Mill extraction, %	72.9	72.0	67.9	68.5
Finisher extraction, %	1.5	1.7	3.2	3.2
Total extraction, %	74.4	73.7	71.1	71.7
Ash, %	0.48	0.51	0.41	0.40
Color, units	1.8	3.5	2.7	1.1

by the Remix procedure (1). The bran-finisher flour shows the high protein content, high ash, poor color, and moderate baking strength expected of this class of flour. Since the amount of bran-finisher flour, in relation to the yield of flour from the mill, is small, there is little change in flour quality when the former is added to the latter.

TABLE II

QUALITIES OF FLOUR FROM FINISHER, COMPARED WITH FLOUR FROM MILL AND TOTAL FLOUR

PROPERTY	FLOUR FROM FINISHER	FLOUR FROM MILL	TOTAL FLOUR
Extraction, %	1.5	72.5	74.0
Protein, %	20.4	12.0	12.1
Wet gluten, %	63.9	35.8	36.1
Ash, %	1.63	0.48	0.50
Color, units	11.8	1.5	1.9
Diastatic activity, mg.	197	229	224
Gassing power, mm.	480	430	435
Baking absorption, %	61.7	60.1	60.2
Loaf volume, cc.	695	810	790
Appearance	2.0	9.7	10.0
Crumb texture	1.3–co	6.2–o	6.3–o
Crumb color	Brown	8.0	7.8

The bran finisher described in this paper has been in use in this laboratory for almost two years. Both operation and maintenance are simple. It has been used more especially for assessing the quality of commercial shipments of wheats of different grades. In this application, the advantage of using extraction rates approximating those obtained commercially are readily apparent. The bran finisher has also been used for investigating the milling properties of varieties. Since the machine may prove useful in other laboratories, a description of it seems warranted.

Literature Cited

1. IRVINE, G. N., and MCMULLAN, MARION E. The "Remix" baking test. Cereal Chem. 37: 603–613 (1960).