

**A MACHINE FOR PULVERIZING AND SIFTING GARI MASH**

by

E.U. ODIGBOH AND S.F. AHMED

Department of Agricultural Engineering University of Nigeria, Nsukka  
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**ABSTRACT:**

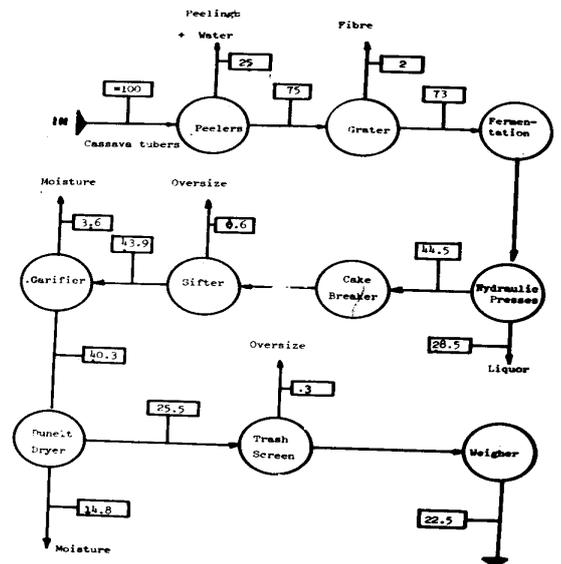
A prototype machine for pulverizing and sifting gari mash, designed as a companion to the gari frying machine developed by the authors, was built and tested. Driven by an electric motor, the prototype accepts lump<sup>3</sup> of dewatered gari mash cuts them up into small pieces by a cake breaker and delivers the pieces by a belt conveyor on to a reciprocating sieve for sifting. The sifted gari mash and chaff exit from the machine continuously but separately. The prototype can handle 125kg of mash per hour to produce sifted gari mash which is more uniform and more wholesome than is possible manually

**INTRODUCTION**

In March 1979, the defunct operation Feed the Nation (O.F.N) national committee contracted the first author to undertake research to design and develop a number of agricultural machines for the primary production and processing of cassava. That programme of research has yielded single-row and two-row versions of a cassava planter, a ridge-profile weeder for cassava fields, a combine-type cassava harvester, a batch-process cassava peeler, a manually operated cassava grating machine, a gari mash pulverize and sifting machine and a continuous-process gari frying machine. Except the pulverize/sifting machine, work on all these machines has already been reported [1, 2, 3, 4, 5, 6]. This paper therefore, discusses the design and development of the prototype machine for pulverizing and sifting dewatered gari mash.

**1.1 The Gari Mash Pulverizing/Sifting Process**

As shown in the gari processing flow chart of Fig. 1, pulverizing and sifting constitute the unit operations immediately preceding garification. The product of the



**Fig. 1: Gari processing Flow Chart**

Fermentation and dewatering processes on grated cassava is a cake of gari mash which has a moisture content of about 40%, wet basis [7]. This cake has to be pulverized and sifted to remove oversize particles and chaff to yield the roduct that is fried to give gari. Pulverization and sifting of the mash are accomplished simultaneously in the traditional processing method. The peasant women

processors do this by manually pressing and rubbing the mash cake against sieves of wire mesh or raffia mat. This traditional manual process is tedious, slow and understandably unhygienic and unwholesome. The prototype pulverizing/sifting machine presented here is designed to serve small-to-medium scale processors and to improve the wholesomeness of the whole process.

## 2. DESCRIPTION OF THE PROTOTYPE

The photograph of the prototype is shown in Fig. 2. More details of the design of the machine are given in Fig. 3. Essentially, the machine consists of a cake breaker, a belt conveyor cum pulverize section and a sifting section, all driven by one single-phase 0.75kw electric motor.

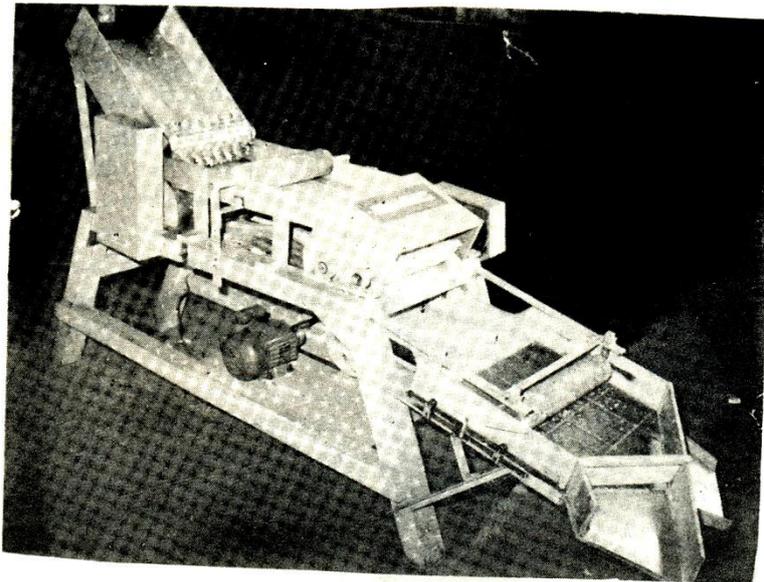
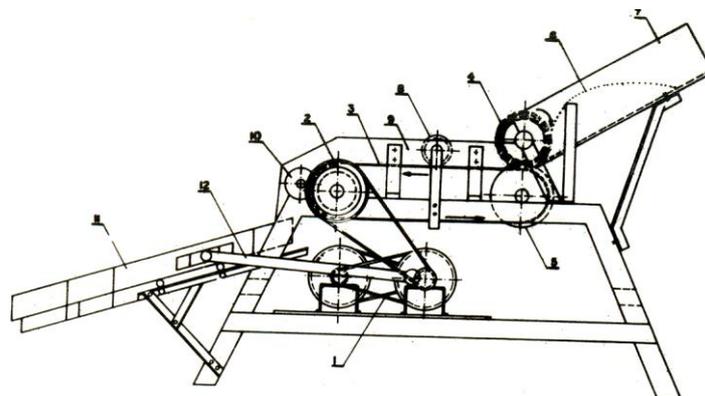


Fig. 2. Photograph of prototype gari pulverizing/sifting machine.



### A Side view of the Prototype Gari mash Pulverize/sifting machine

1. Vee-belt drives; 2. Head pulley; 3 belt conveyor; 4, cake breaker, 5. tail pulley; 6. lump or cake of ' gari mash; 7hopper; 8pulverizing roller; 9. Side gaurds; 10.brush 11. Reciprocating sleve; 12. Pitman.

As illustrated in Fig. 3, the speed of the electric motor drive shaft is stepped down through a three-stage vee-belt drive(1) to drive the head pulley (2) of the belt conveyor (3) . The mash cake breaker(4) which consists of a cylinder of spikes made of strips of galvanized iron plate (see Fig.

2) gear-driven from the shaft of the tail pulley(5) of the belt conveyor. The cake breaker therefore, rotates as shown to cut the lump of gari mash(6) in the hopper(7) into small pieces and delivers them on to the belt conveyor. The hopper is inclined at 35° to the horizontal to facilitate the sliding of the mass

of mash on to the cake breaker.

A freely rotating roller(8) covered with 6.5 x 6.5mm wire mesh, is mounted in the position shown, at an adjustable height of 1.5 to 3.5mm above the belt conveyor. The function of this roller is to further pulverize the pieces of gari mash from the cake breaker. Side gaurds (9) are provided to prevent the pulverized mash from falling off the sides of the conveyor belt. Immediately after the head pulley, a cylindrical brush (10) is mounted to be in light touch with the belt conveyor, along the horizontal diameter of the head pulley. The brush is belt driven from the shaft of the head pulley. Its function is to brush the pulverized mash off the belt conveyor and on to the reciprocating sieve (11) .The sieve is made of 3.25 x 3.25mm rhomb shaped wire mesh, framed with flat bars of aluminum to form the sifting tray. At the intake end of the sifting tray,

dividers are provided to distribute the pulverized mash uniformly across the width of the tray for more effective use of the entire sifting surface. The reciprocating action of the sieve is effected by the pitman (12) driven from an eccentric mounted on the shaft of the second-stage belt drive, to give 130 reversals of the sieve per minute. The sieve is inclined at 20° to the horizontal. At about the middle of the tray is located a roller which is covered with the same wire mesh used for the sieve. This roller is mounted so as to be nearly in contact with the sieve. It is free to rotate about its axis as it comes contact with the mash in the tray, clock-wise as the sieve moves forward and anti-clockwise as the sieve moves backward. Thus, the roller acts to press and rub the gari mash against the sieve and thereby effect sifting.

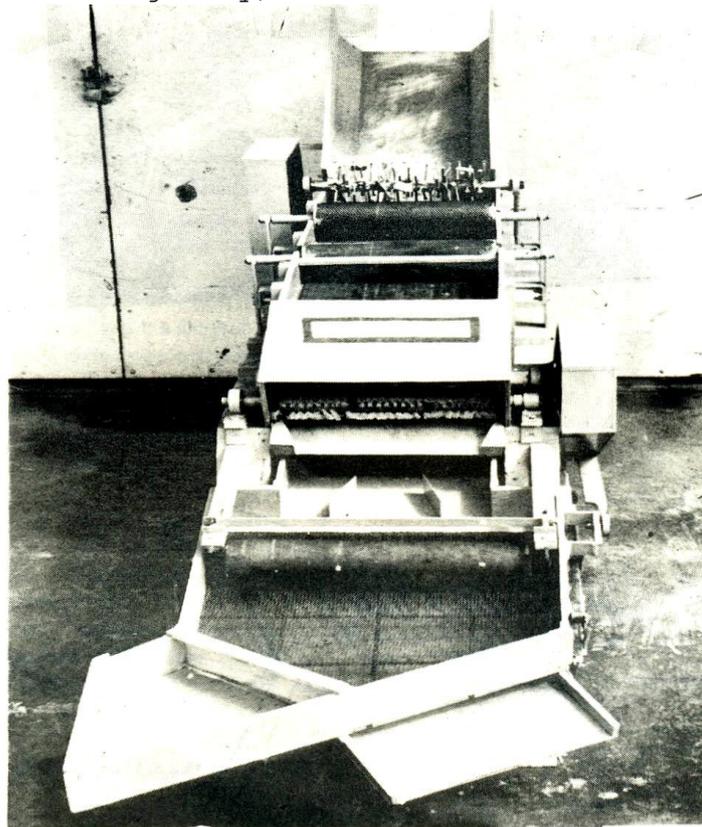


Fig. 4 Top view of the machine showing

Cake breaker (1), brush (2). Pulverized mash dividers (3), sifting roller (4), chaff exit (5) and sifted mash exit (6)

At the underside of the sifting tray, there is attached an aluminum plate on to which the sifted mash is deposited and thence flows out to the collection point. The chaff and oversize particles which are left on the sieve also move down the slope to a separate collection point. The shape of the sifting tray and the collection plate underneath which facilitates the separate and simultaneous collection of the chaff and the sifted mash is clearly shown in the photograph of Fig.4. Being a view from the top, Fig. 4 also shows clearly the cylindrical brush, the mash dividers in the sifting tray as well as the sifting roller.

### 3. PERFORMANCE OF THE MACHINE

To operate, the dewatered gari mash which is a lump having the shape of the container in which the dewatering is done, is placed in the hopper. The electric motor is switched on and thence, the machine operates automatically. The cake breaker engages the lump of gari mash, gradually cuts it up and partially pulverizes it into small pieces which it delivers to the belt conveyor. The pieces of gari mash are further pulverized as it is transported in a fairly uniform and continuous layer past the freely rotating roller and on to the reciprocating sifting tray. The sifting roller in the tray presses and robs the gari mash against the wire mesh of the sieve, in much the same way as the peasant women processor do traditionally, Sifting and separation of chaff and oversize particles are accomplished simultaneously. The sifted gari mash and the chaff are collected continuously but separately as described before. The prototype has a throughput of 125kg of mash per hour. This capacity is more than 15 times the average manual

rate. What is more, the product is more uniform in particle size and a lot more wholesome than is possible manually.

### 4. CONCLUSION

The performance of this proto-type gari mash pulverizer/sifting machine is very satisfactory. Its technical characteristics and capacity are such that it can work very well as a companion to the prototype gari frying machine designed by the authors [2]. This means that it can serve small-to-medium scale commercial gari processors well. However, it may not be technically suitable for peasant family unit processors. It will be necessary to modify the design to a scaled-down version which can be manually operated to go with the manually operated version of the gari frying machine cited in the above reference. This indicated modification is currently being undertaken.

### ACKNOWLEDGEMENT

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