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Grain Milling Expert
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for the Grain Industry

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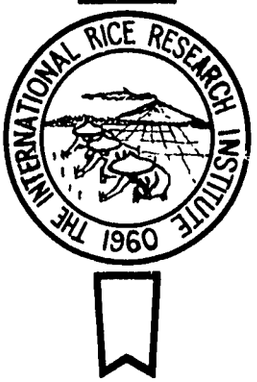

RECENT DEVELOPMENTS IN THE RICE MILLING INDUSTRY OF THE PHILIPPINES

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TRAINING OF TECHNICIANS FOR THE GRAIN INDUSTRY

The introduction of the new high yielding rice varieties results in a considerable increase in the production of paddy per hectare and the area planted with these varieties is constantly expanding.

Consequently, more paddy will be produced and is to be milled.

At the same time the "war on waste" has been declared by the Food and Agricultural Organization.

In the Republic of the Philippines timely attention has been paid to cope with these two objectives namely, the improvement of both the milling capacity and the milling efficiency in order to process the constantly increasing rice crop under conditions which will secure a higher white rice recovery. In this respect three sectors of the rice milling industry in the Philippines are to be considered, namely:

1. About 8 thousand Engelberght type milling units which are processing on village level about 40% to 45% of the total paddy crop.

2. About 2 thousand commercial rice mills of the conventional cone type, milling about 50% of the total crop.

3. The newly installed rice mill centrals.

1. On village level, about 8,000 Engelberght type milling units (locally named Kiskisan) are being used. This type of machine hulls and whitens the rice in one simple combined operation and its operation principle

requires the implementation of excessive pressure and friction on the grain.

Consequently, the percentage of brokens is very high and the average white rice recovery is as low as 60% by weight.

The horsepower consumption in relation to the intake capacity of the machines is very high (about 15 HP for 300/350 kg paddy per hour).

The maintenance expenses are considerable.

In recent years a small hulling/whitening unit has been developed in the Philippines, has been tested extensively, and a large number of recommended improvements have been implemented.

The aim of this small milling unit is to present a substitute for the inefficient Engelberght type machines of about the same capacity and price, but:

- having a higher rice recovery
- requiring less H.P.
- being cheaper in maintenance, and
- entirely being made in the Philippines

These objectives were achieved during a second series of test-runs on the improved version of this machine, called the "Konopak Milling Unit."

The intake capacity now is about 250 kg/hour.

The recovery by weight is about 68/69%.

The horsepower consumption is about 7.5 HP for 250 kg/hr.

The maintenance expenses are very low.

The prospects for this type of machine are bright, however, still a number of improvements are to be implemented before this machine can be produced in series taking interchangeability of parts into account.

About 20 units were made - custombilt - and are now in operation.

However, the absence of financial support necessary for a larger scale series production seems to be responsible for a slow-down in the introduction of this unit.

2. Close to the two thousand cone type rice mills are in operation in the Philippines. Practically all of these rice mills were and still are produced by the local industry and the input capacities vary from 1 ton per hour up to 8 tons per hour.

The design is based on pre-war German lay-outs, however, simplification have been introduced in order to reduce the investments per milling unit.

In general these mills consist of the following components:

- open precleaning through oscillating sieves,
- underrunner disc huller with full emery coating,
- husk aspiration through high speed suction blowers,
- multi-compartment paddy separator,
- one or two whitening cones with full emery coating,
- oscillating sieve for the separation of germs and points,
- no grading of the rice is done.

In spite of the fact that this layout of machines is rather limited, the overall performance of the mills is not so bad and during test runs on these standard mills, recoveries by weight of about 69% and more have been recorded.

Nevertheless the mill design can easily be improved having as objectives:

- to increase the intake capacities,
- to increase the recovery,
- to reduce the free flow of dust.

It is practically impossible to brief each miller personally on the advantages of the recommended improvements and therefore these improvements in first instance were discussed with the manufacturers of the locally made cone type rice mills for implementation in new mills and recommendation to the established millers through their own sales organization.

On the other hand, the association of rice millers were supplied with data on these improvements so that through these organizations rice millers could be informed.

The recommended improvements can be summarized as follows:

Precleaning Section

a. The introduction of dust aspiration (See Appendix 1).

b. The introduction of self-cleaning sieves (See Appendix 2).

Hulling Section

a. Control of the peripheral speed of the discs fixed at about 14 m/sec. (See Appendix 3).

b. Control of the width of the effective disc surface in relation to the disc diameter (See Appendiz 3).

c. The introduction of silicium carbide (carborundum) grit as a second grit component for the disc coating (See Appendix 3).

Return Hulling

The rejected paddy from the paddy separator (return paddy) should be hulled in a separate return huller of the emergy/carborundum disc type or rubber roll type (See Appendix 4).

The capacity of the return huller should be 25% of the mill intake capacity or more.

Sieve

The oscillating sieves in between the hulling section and the paddy separator should be made self-cleaning through the introduction of rubber balls (See Appendix 2).

Husk Aspiration

The husk aspiration through high speed suction blowers is to be replaced by low speed high capacity compact aspirators.

Whitening Cones

a. Multipass whitening through at least three cones of equal diameter is recommended (See Appendix 6).

b. Control of the peripheral speed of the cones, fixed at about 13 m/sec (See Appendix 5).

c. The introduction of silicum carbide grit as a second grit component for the cone coating (See Appendix 5).

Grading

The grading and mixing of white rice, when necessary, can be done with the following innovations:

- plansifters
- trieurs (rotating cylinders with indented steel linings)
- volumetric mixers
- belt conveyors

This is especially relevant where high-grade rice is required (See Appendix 7).

The response of the local manufacturing industry towards these recommendations is very positive and the implementation gains field.

New improved precleaners have been designed.

A number of these manufacturers are now introducing self-cleaning sieves, return hulling and multipass whitening. Silicium carbide was ordered from abroad in order to improve the composition of the coatings of both the huller discs and cones.

New large capacity rice centrals have been constructed and are under construction. These projects include bulk storage and mechanical drying as well.

In this respect, three projects of special importance can be mentioned. However, more centrals of smaller capacity have been erected and are under consideration.

Project 1

In Tacurong in the province of South Cotabato, Mindanao, a fully integrated rice complex is under construction.

When completed, the total storage capacity in concrete silos will be about 18,000 metric tons.

A large capacity paddy drying plant is installed and when completed will have a throughout capacity of about 51 tons per hour for 2 to 3 points moisture reduction.

The capacity of the rice mill will be 25 tons/hour in two units of 12-1/2 tons/hour each, full grading and packaging included.

The bran of the rice mill is pelletized and the bran oil is extracted in a solvent extraction plant.

The husks are burned in a large furnace, heating two high capacity steamboilers of which the high pressure steam is driving three steam engines. These steam engines are direct coupled to generators able to produce 2,400 KVA at top capacity.

This power plant supplies all the electricity to the rice central and a surplus will be available for a farmer's housing project.

The low pressure steam coming from the steam engines is used in the extraction plant. The rice mill central is integrated with a 20,000 HA rice from full mechanization will be introduced.

The farmers are stockholders in this private corporation.

The equipment is supplied by MIAG of West Germany.

Project 2

In Bay, Laguna, about 5 km. from Los Baños, a large integrated rice mill complex has recently been put in operation, which is owned by the Philippine Seeds Inc.

Here, a new type of bulk storage system was introduced. It was supplied by Simplex of England and consists out of 88 bins each having a capacity of 65 M.T.

The flooring is of the airsweep type so that the air, normally available for aeration, can be used for bin unloading. The plant has two large mechanical driers of 10 ton/pass each, supplied by SATAKE Japan and a well designed tempering system guarantees an optimum drying performance. The mill is supplied and installed by SATAKE and has a capacity of 10 tons per hour.

The rice mill is equipped with full grading, mixing, and packaging equipment.

The flexibility in the grain flow makes it possible to meet a large range of quality grades for the domestic market as well as for export.

Project 3

In Quezon City a 6 tons/hour rice whitening plant has been installed

and put in operation. This plant receives the cargo rice (brown rice still holding some paddy) from the rice producing areas and produces white rice for the local market as well as for export. The installation includes full grading, mixing and packaging equipment. Also, here, the grain flow flexibility enables the miller to meet a wide range of quality requirements.

The installation is supplied by BIAG, West Germany.

The owner of this plant is the Mindanao Progress Corporation, which is also the owner of the large integrated project in Tacurong.

In both projects, a maximum use is made of grain flow by gravity and for that reason the rice mill equipment was installed in multi-storey buildings (6 floors).

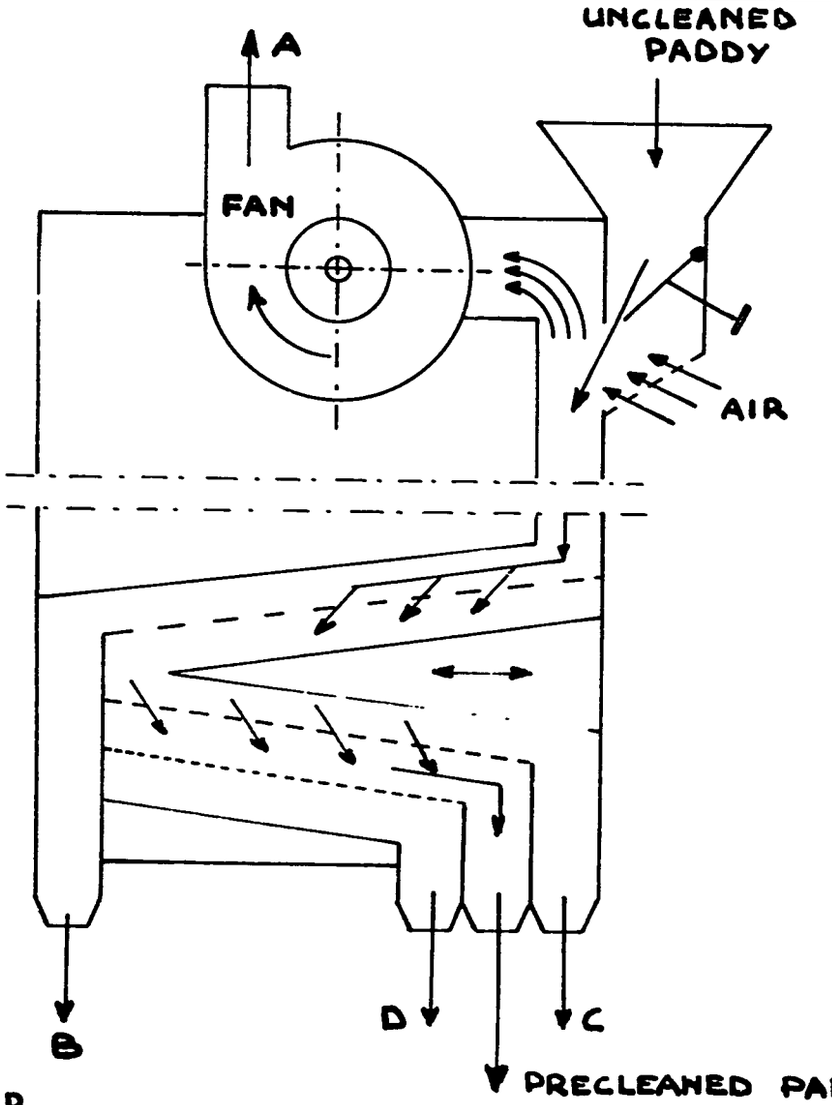
For large centrals the technical design is rather complicated and in many aspects the local manufacturing industry will not be able to meet all the machinery requirements.

West German, English, Italian and Japanese made rice milling machines can meet these requirements. However, continuous attention is to be paid to the full adjustment of these machines and the machine lay-out, so that the mill will be able to meet the conditions in the Philippines, especially in relation to the varieties of paddy normally grown in this country.

In this respect, the Japanese made machines are facing more problems than European made machines because the Japanese made machines are basically designed for short round paddy varieties.

Nevertheless, these machines, when properly rearranged, can meet high standard requirements.

PRECLEANING



IMPURITIES

A - DUST EMPTY HUSKS ETC.

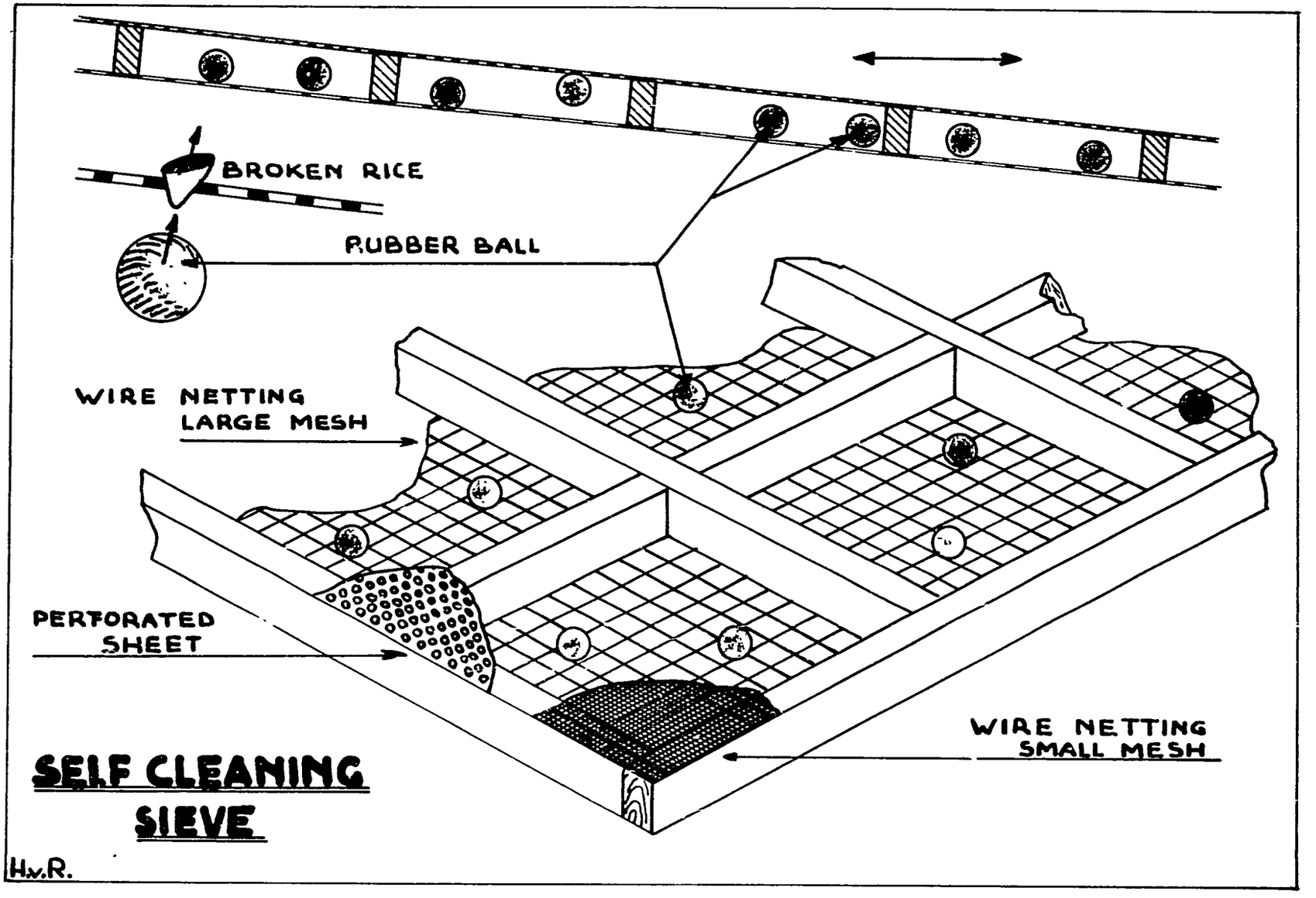
B - LARGE IMPURITIES

C - MEDIUM SIZE IMPURITIES

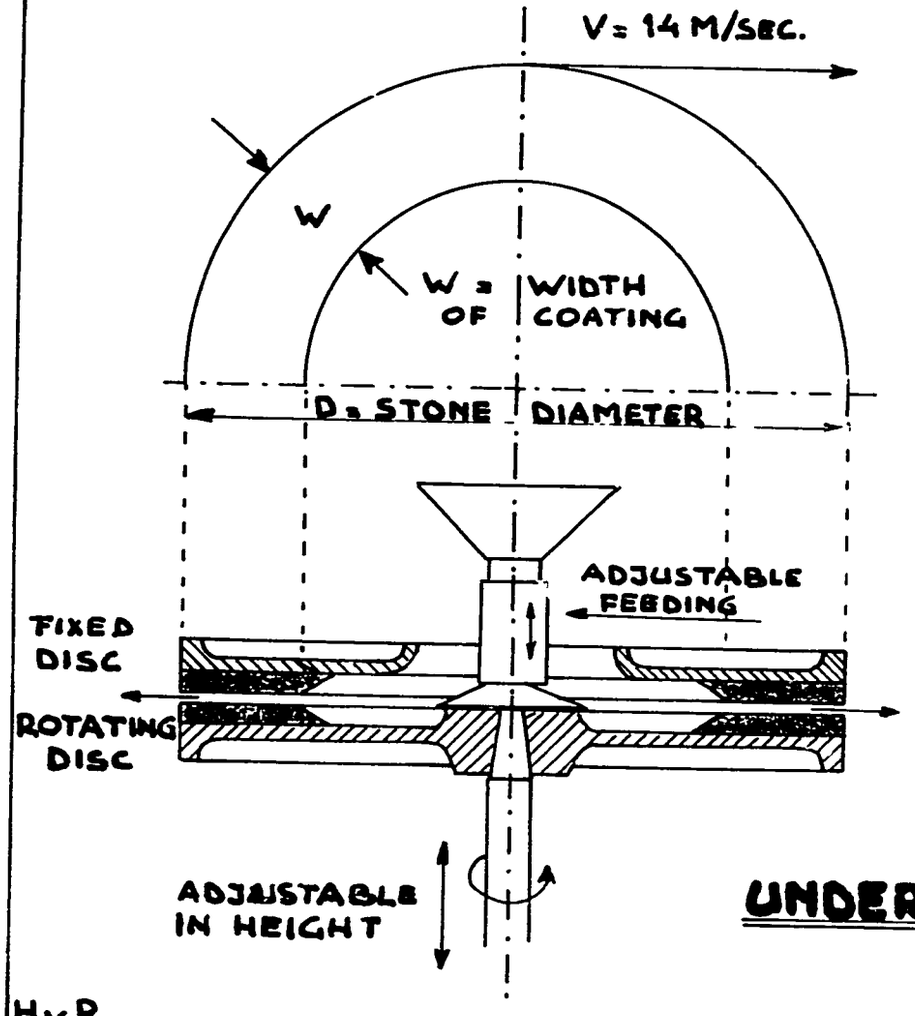
D - SAND

H.v.R

APPENDIX - 1


BROKEN RICE
RUBBER BALL
WIRE NETTING
LARGE MESH
PERFORATED
SHEET
WIRE NETTING
SMALL MESH
SELF CLEANING
SIEVE
H.v.R.

APPENDIX-2



RECOMMENDED PERIPHICAL SPEED:

14 METERS PER SECOND

WIDTH OF COATING / STONE DIAMETER $= \frac{W}{D} = \frac{1}{6}$ OR $\frac{1}{7}$

RECOMMENDED COMPOSITION OF COATING

50 %	EMERY GRIT 14
16⅔ %	EMERY GRIT 16
33⅓ %	SILICIUM CARBIDE 16
100 %	GRIT
20 %	MAGNESITE
20 %	MAGNESIUM CHLORIDE BRINE 29° BEAMÉ

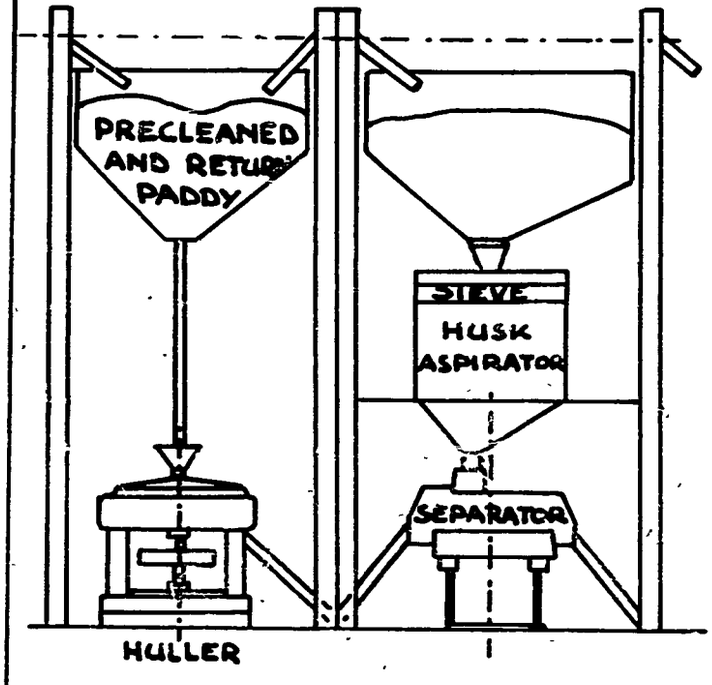
UNDER-RUNNER DISC HULLER

H.v.R.

APPENDIX-3

RETURN HULLING

NOT RECOMMENDED GRAINFLOW

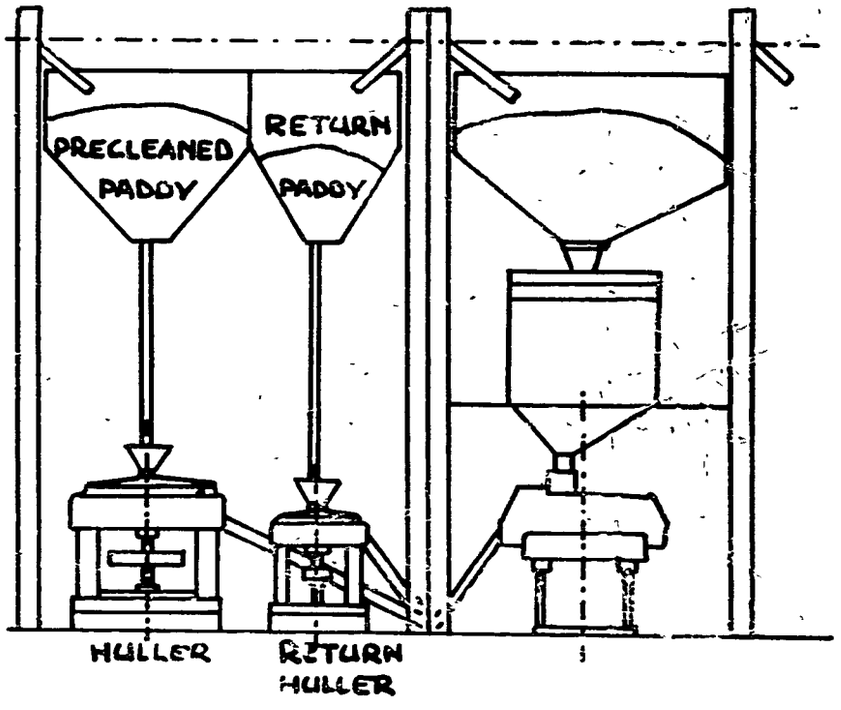


HULLING SECTION OF RICE MILL

WITHOUT

SEPARATE RETURN HULLING

RECOMMENDED RETURN-HULLING



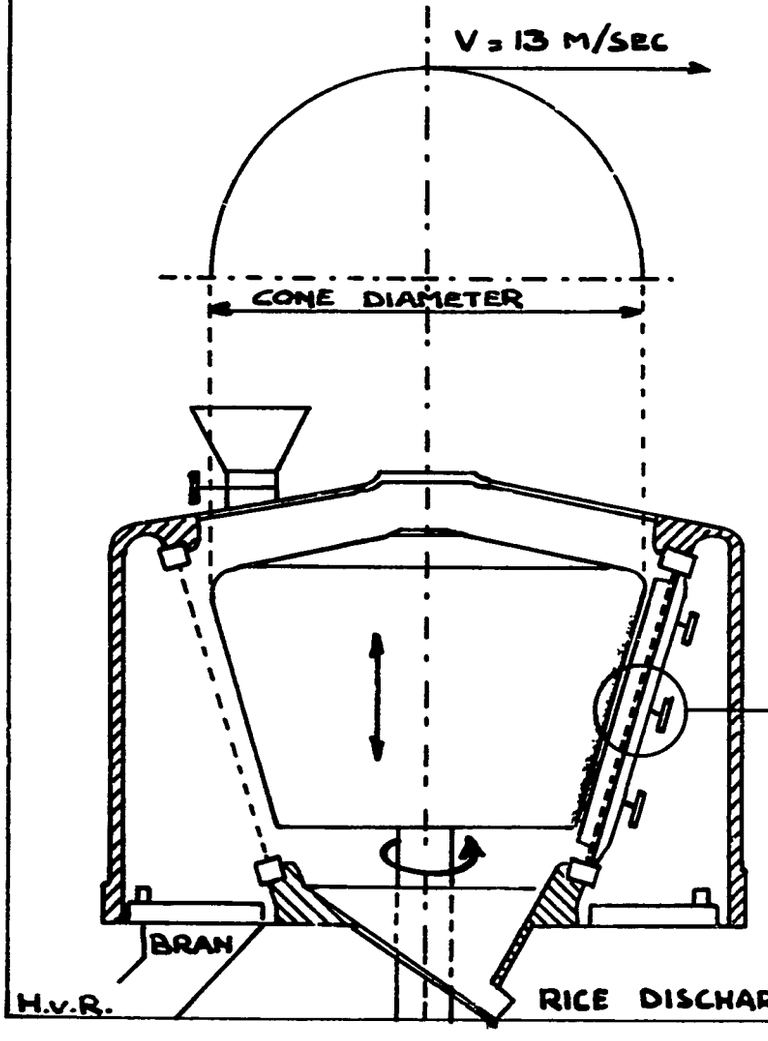
HULLING SECTION OF RICE-MILL WITH

SEPARATE RETURN HULLING

H.V.R.

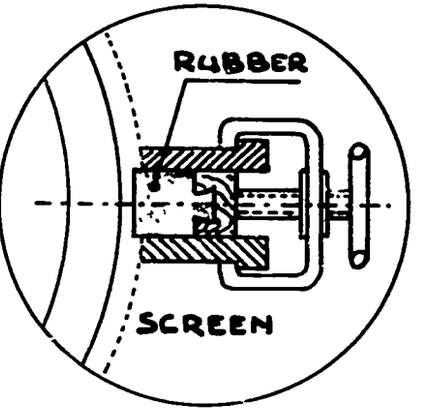
APPENDIX-4

WHITENING CONE

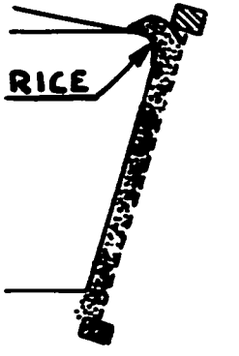


RECOMMENDED COMPOSITION FOR COATING

25% EMERY GRIT 16
50% SILICIUM CARBIDE 16
25% SILICIUM CARBIDE 18 or 20
100% GRIT
20% MAGNESITE
20% MAGNESIUM CHLORIDE
BRINE 30° BEAMÉ



ADJUSTABLE RUBBER BRAKE



WHITENING CONE SHOULD ALWAYS BE FULLY LOADED

APPENDIX- 5

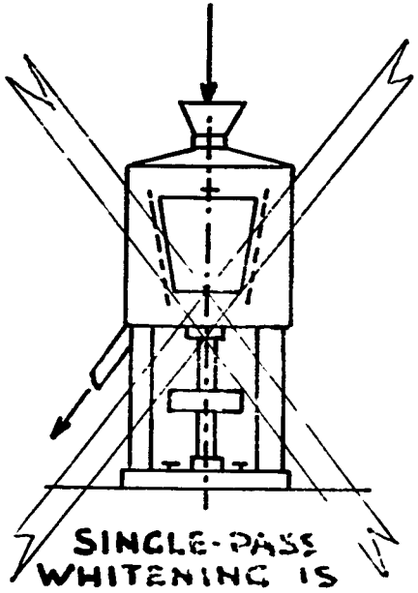
NOT RECOMMENDED

BY SINGLE-PASS WHITENING

- HIGH FRICTION
- HEAT

RESULTING IN

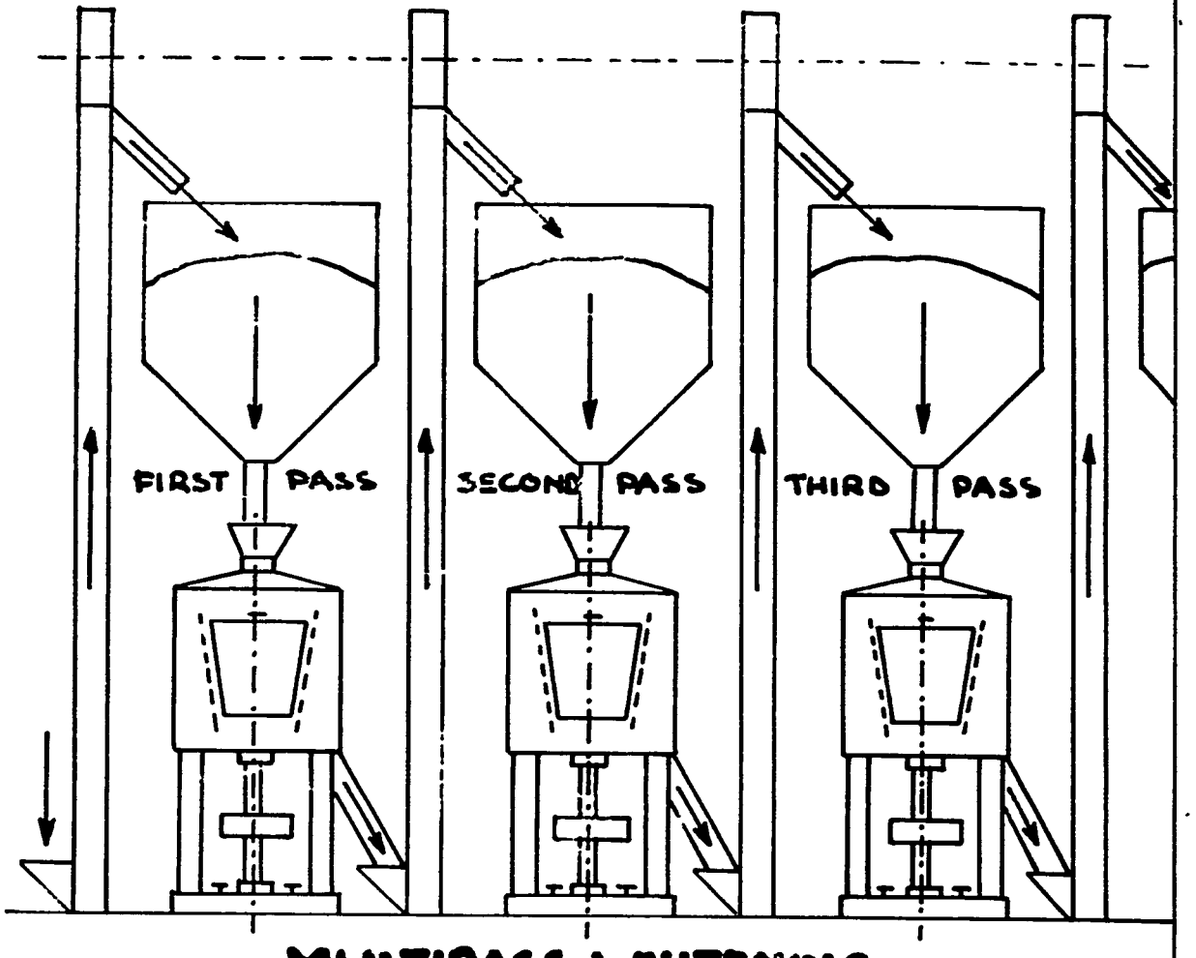
- MUCH BROKENS
- LOW RECOVERY



SINGLE-PASS WHITENING IS WRONG

H.v.B.

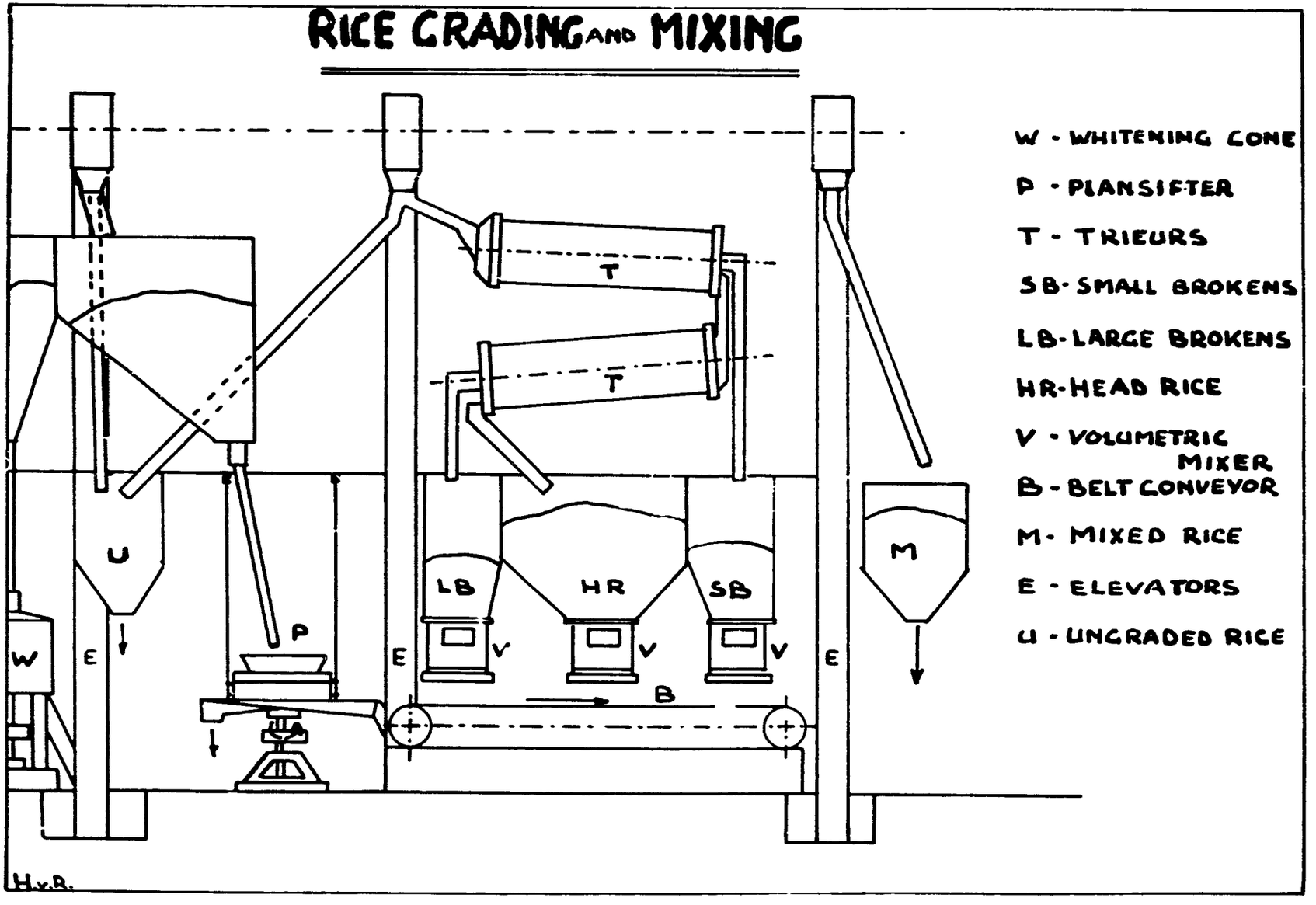
RECOMMENDED



MULTIPASS WHITENING

REDUCED FRICTION RESULTS IN HIGHER RECOVERY

APPENDIX- 6


RICE GRADING AND MIXING
W - WHITENING CONE
P - PLANSIFTER
T - TRIEURS
SB - SMALL BROKENS
LB - LARGE BROKENS
HR - HEAD RICE
V - VOLUMETRIC MIXER
B - BELT CONVEYOR
M - MIXED RICE
E - ELEVATORS
U - UNGRADED RICE
T
T
U
LB
HR
SB
M
W
E
P
E
V
V
V
E
B
H.v.R.

APPENDIX - 7