Universidad del Valle

CIRAD

TECHNICAL CATALOGS

MACHINERY AND EQUIPMENT FOR CASSAVA STARCH EXTRACTION

OPERATING PRINCIPLES, CHARACTERISTICS, AND TECHNOLOGICAL IMPROVEMENTS

CASSAVA UTILIZATION SECTION
CIAT
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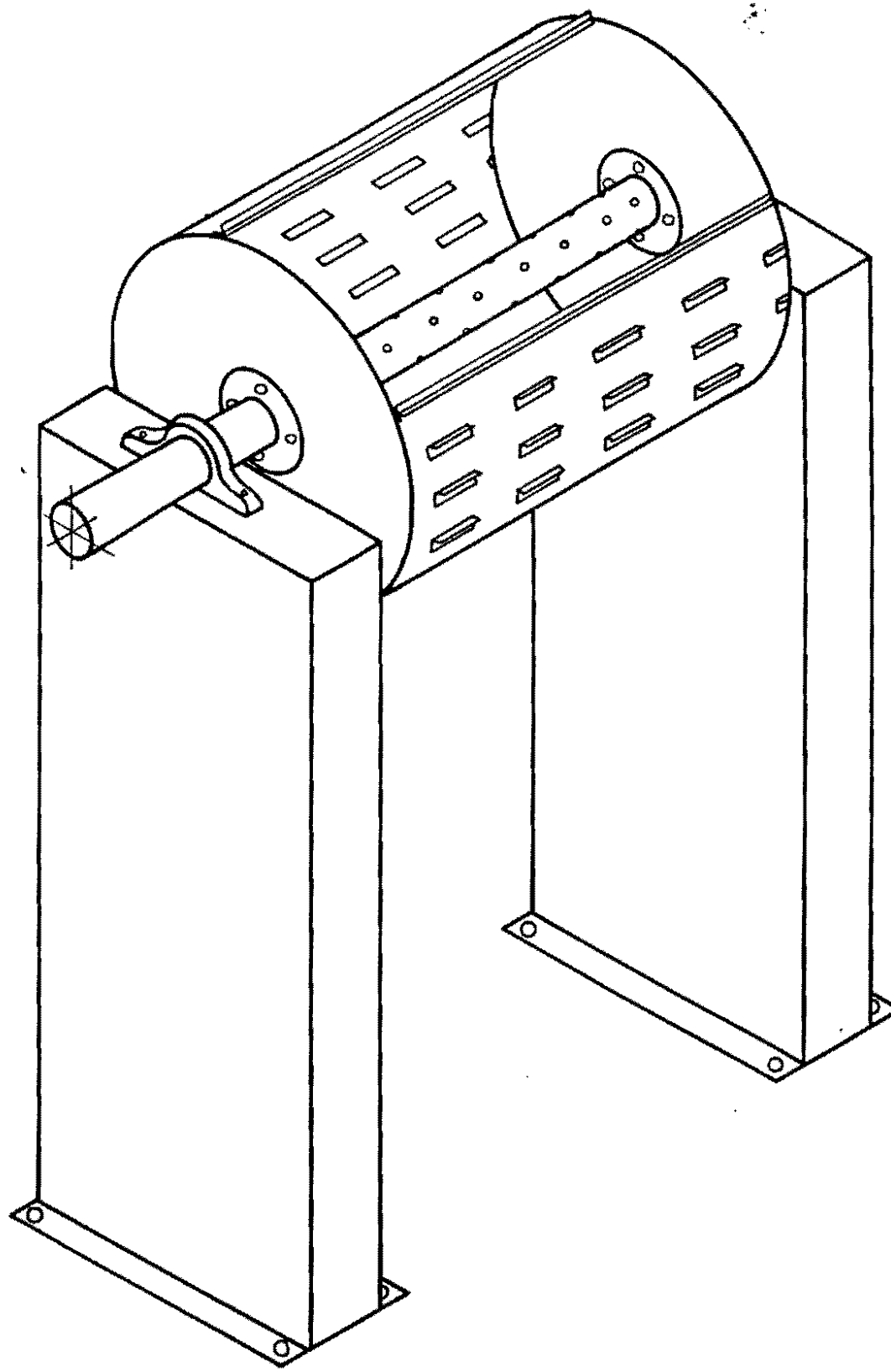
CASSAVA WASHING - PEELING MACHINE



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CASSAVA WASHING AND PEELING MACHINE

CATALOG No. 1

OPERATING PRINCIPLE:

The machine receives the roots, washing them of the sand and dirt left after harvest. It also peels them. The process consumes large amounts of water (approximately 2-8 m^3 per ton of roots). Roots are peeled by friction against the machine's walls and among themselves, thus reducing the impurities in the final product. The washed and peeled roots are fed to the rasper (CATALOG No. 2) for subsequent grating.

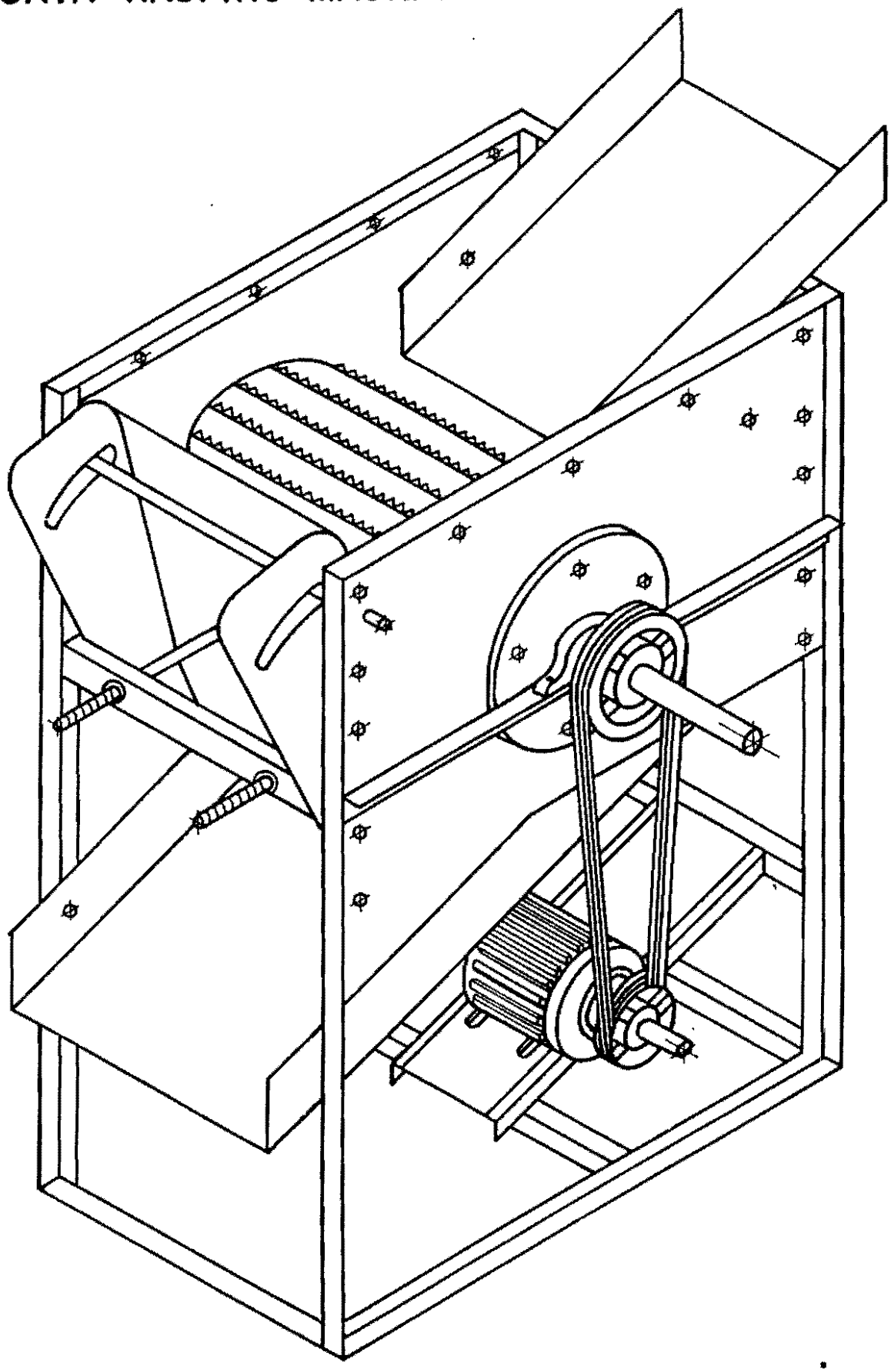
CHARACTERISTICS:

- Modular metal structure in commercial steel.
- Capacity: 2-3 ton of roots per hour.
- Power: 2 HP (2 CV).
- Rotation washing and peeling at Velocity: 36 rpm.
- Water consumption: 36-54 liters per minute.

TECHNOLOGICAL IMPROVEMENTS:

- The power is supplied directly by the machine's own reduction motor.
- Central tubular shaft with perforations for water supply and machine support.
- The outer wall is metallic and perforated for the escape of water and impurities (peel and dirt). It has a lateral gliding cover for manually feeding of roots (batch feeding).
- Washing efficiency: 78% - 86%.
- Approximate cost: US$1500-1800, according to the capacity of the processing machine.

CASSAVA RASPING MACHINE



CASSAVA RASPING MACHINE

CATALOG No. 2

OPERATING PRINCIPLE:

The peeled and washed roots coming from the washing and peeling machine (CATALOG No.1) are fed to the rasper. The objective is to break down the cell walls in the roots, liberating cassava starch granules, which are then separated through a cylindrical screen (CATALOG No. 3).

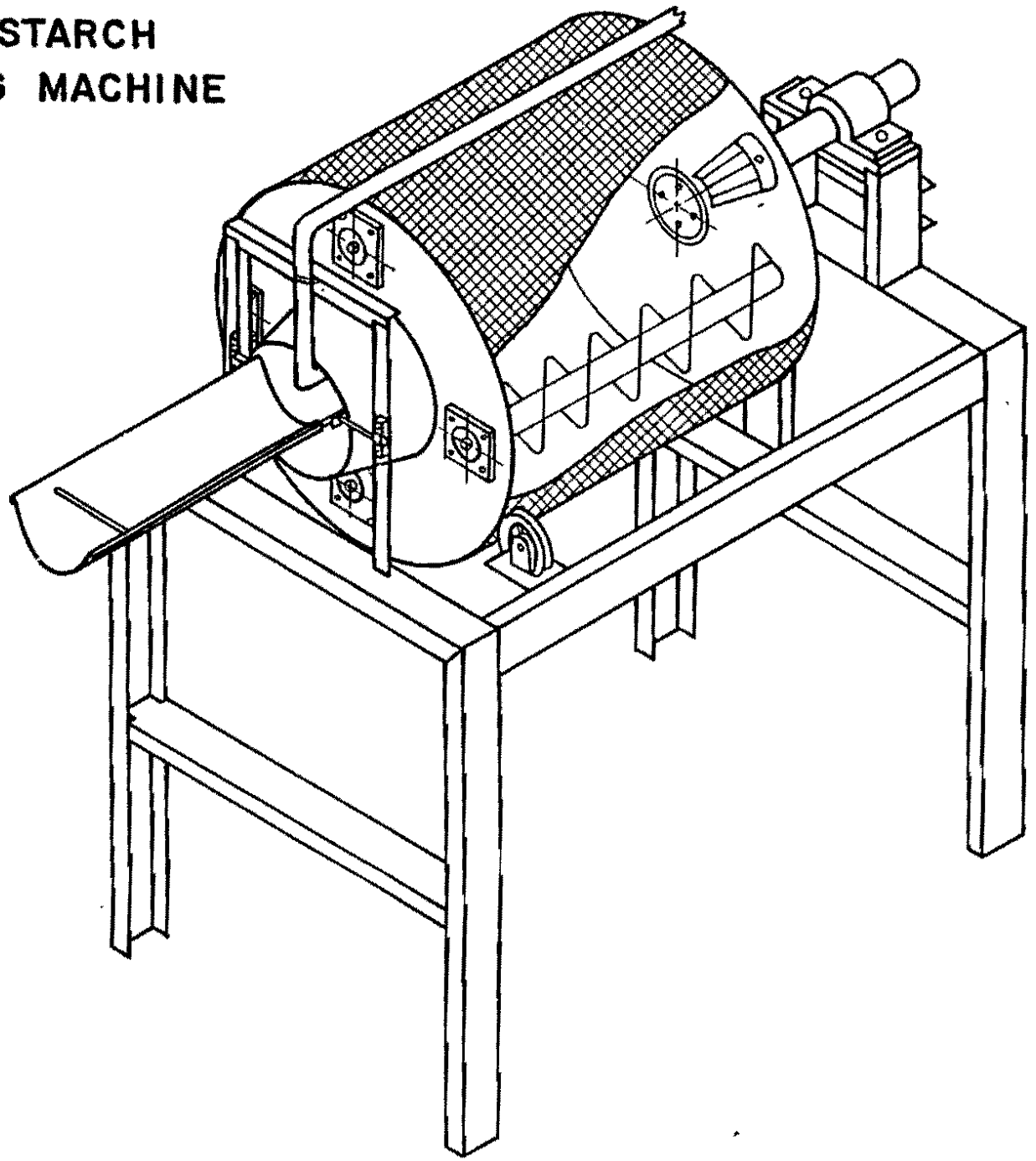
CHARACTERISTICS:

- The process can be executed under dry or wet conditions.
- Modular metal structure and angle iron in commercial steel.
- Capacity: 1-3 tons of roots per hour.
- Rotation rasping velocity: 1,200-3,000 rpm.
- Lineal rasping velocity: 24-28 m/sec.
- Power: 3-5 HP (3-5 CV).

TECHNOLOGICAL IMPROVEMENTS:

- The power is supplied directly by the machine's own reduction motor, aluminum pulleys, and V rubber belts.
- The raspering cylinder has 2 lateral metal covers and 1 shaft in commercial steel, wooden bars of chanul or oak, and saws with steel teeth, all of which are easy to exchange.
- The useful life of the wood and saws is about 60 to 120 days, depending on the accidents that occur (presence of dirt, twigs, stones, nails, etc.).
- Manual (Batch) or continual feeding of roots.
- The rasping effect: 81% - 89%
- Approximate cost: US$400-500, according to the capacity of the processing machine.

CASSAVA STARCH SCREENING MACHINE



CASSAVA STARCH SCREENING MACHINE

CATALOG No. 3

OPERATING PRINCIPLE:

This metal rotating drum separates cassava starch granules from the pulp coming from the rasper (CATALOG No. 2). Water consumption is high (about 7-10 m^3 per ton of roots), being used to mix, transport, and separate the fine granules (starch milk) from the thick and medium pulp. The fiber (bran) is retained within the drum and the starch milk passes through to the vibrating sieve (CATALOG No. 4).

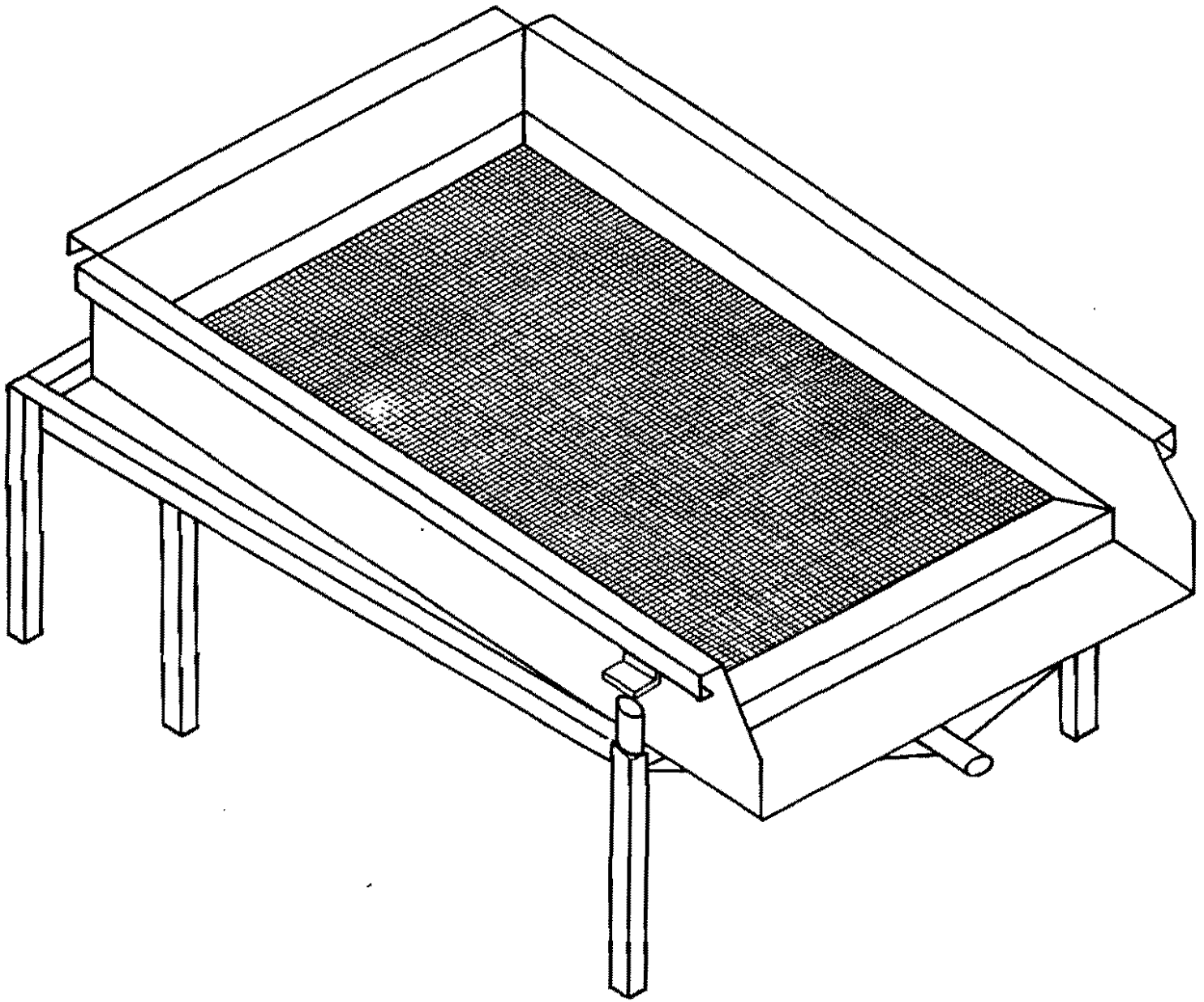
CHARACTERISTICS:

- Modular metal structure in commercial steel.
- Rotating drum velocity: 15 rpm; and endless screws: 30 rpm.
- Capacity: 300 kg rasped mash/hour.
- Water consumption: 36-54 liters/min.
- Power: 2 HP (2 CV).

TECHNOLOGICAL IMPROVEMENTS:

- The power is supplied directly by the machine's own reduction motor, aluminum pulleys, and V rubber belts.
- Within its interior the rotating drum has 4 mechanized endless screws, which are connected to the gear wheel by chain transmission. Their main function is to increase the mixing and contact between pulp and water by carrying them from one end of the drum to the other.
- The inner mesh is of stainless steel, with a 40 gauge (0.414 mm or 0.0613 mm).
- Approximate cost: US$1,500-2,000, according to the capacity of the processing machine.

CASSAVA STARCH VIBRATING SIEVE MACHINE



CASSAVA STARCH VIBRATING SIEVE

CATALOG No. 4

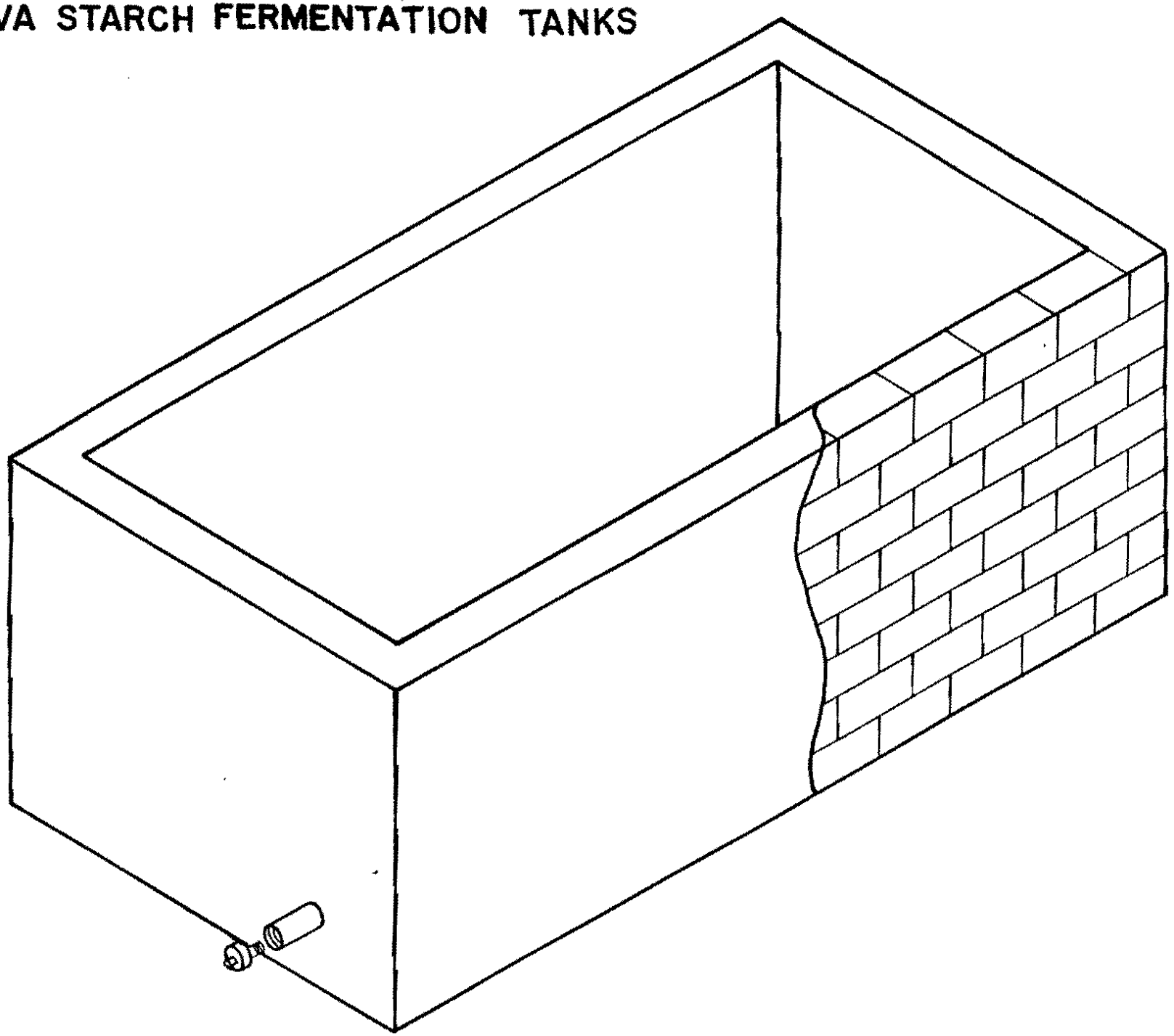
OPERATING PRINCIPLE:

The sieve receives starch milk from the screening machine (CATALOG No. 3) and, by agitating, separates the starch granules from the fine fiber. The sieving improves the level of starch extraction, and reduces impurities (bran), thus obtaining a purer starch. The remaining starch milk passes to fermentation tanks or sedimentation channels (CATALOG Nos 5 and 6).

CHARACTERISTICS:

- Modular metal structure in commercial steel.
- The power is supplied directly by the machine's own reduction motor, aluminum pulleys, and V rubber belts.
- Agitation is supply through a crankshaft-rod mechanism.
- Oscillation velocity: 420 rpm.
- Amplitude of oscillation: 60-100 mm.
- Inclination angle of the sieve: 8°-10°.
- Stainless steel, plastic, or nylon mesh with a 100 to 140 gauge (0.147-0.105 mm).
- Power: 1-2 HP (1-2 CV).
- Approximate cost: US$1,000-1,500, according to the capacity of the processing machine.

CASSAVA STARCH FERMENTATION TANKS



CASSAVA STARCH FERMENTATION TANKS

CATALOG No. 5

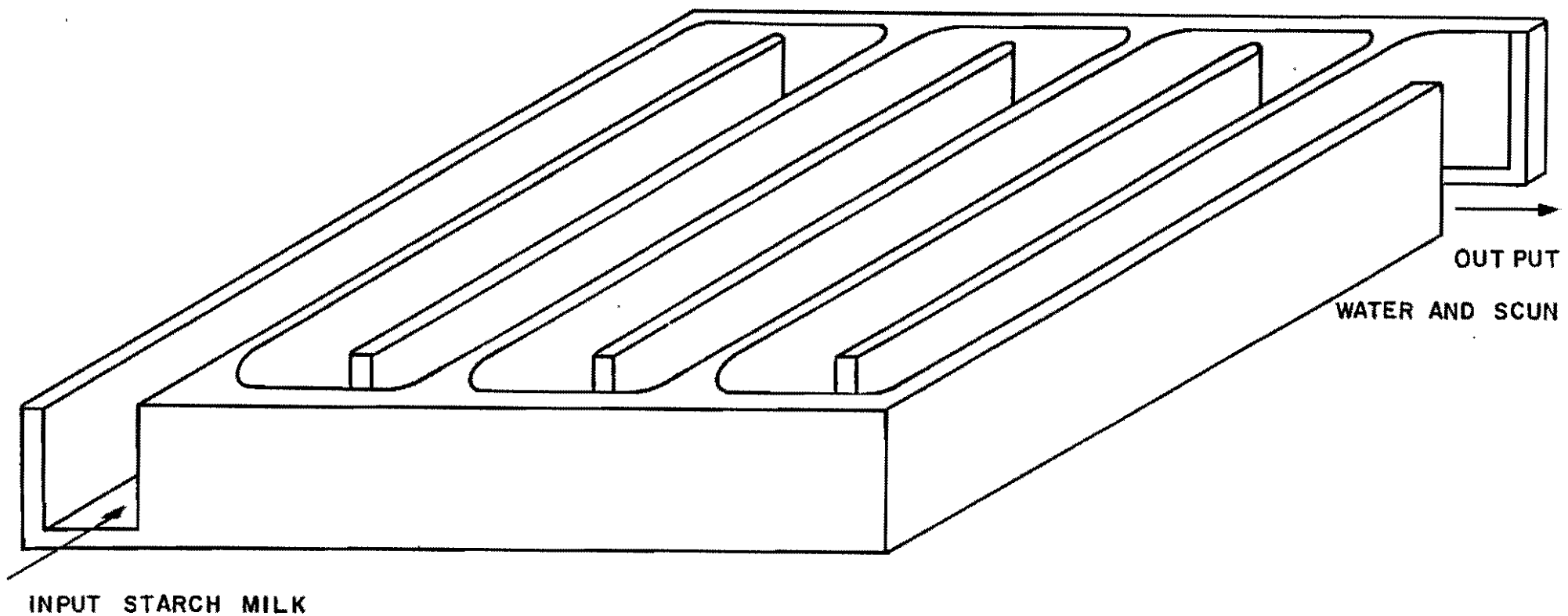
OPERATING PRINCIPLE:

The fermentation tanks receive starch milk from the screening machine (CATALOG No. 3) or vibrating sieve (CATALOG No. 4). The starch milk contains starch granules, proteins, and fine fiber. The milk falls into the tank and decants over a period in which the starch granules separate from the other components. About 6-8 hours after the starch has settled, a gelatinous yellow scum appears on the starch. This is removed and the deposited starch collected for drying in the yard or on trays (CATALOG No. 7).

CHARACTERISTICS:

- Dimensions differ according to the production capacity of the processing plant. Standard measurements are: **Length**: 1.2 m, **Width**: 1.2 m, and **Height**: 1.1 m.
- The starch milk in the tank permits enzymatic decomposition and starch fermentation.
- The tank structure is brick, plastered with cement. To smooth out the inner walls, tiles of porcelain, wood, or other material are used, according to budget and preferences.
- While the starch milk is settling, the tank floor should be slightly inclined to let the top water flow out.

CASSAVA STARCH SEDIMENTATION CHANNELS



CASSAVA STARCH SEDIMENTATION CHANNELS

CATALOG No. 6

OPERATING PRINCIPLE:

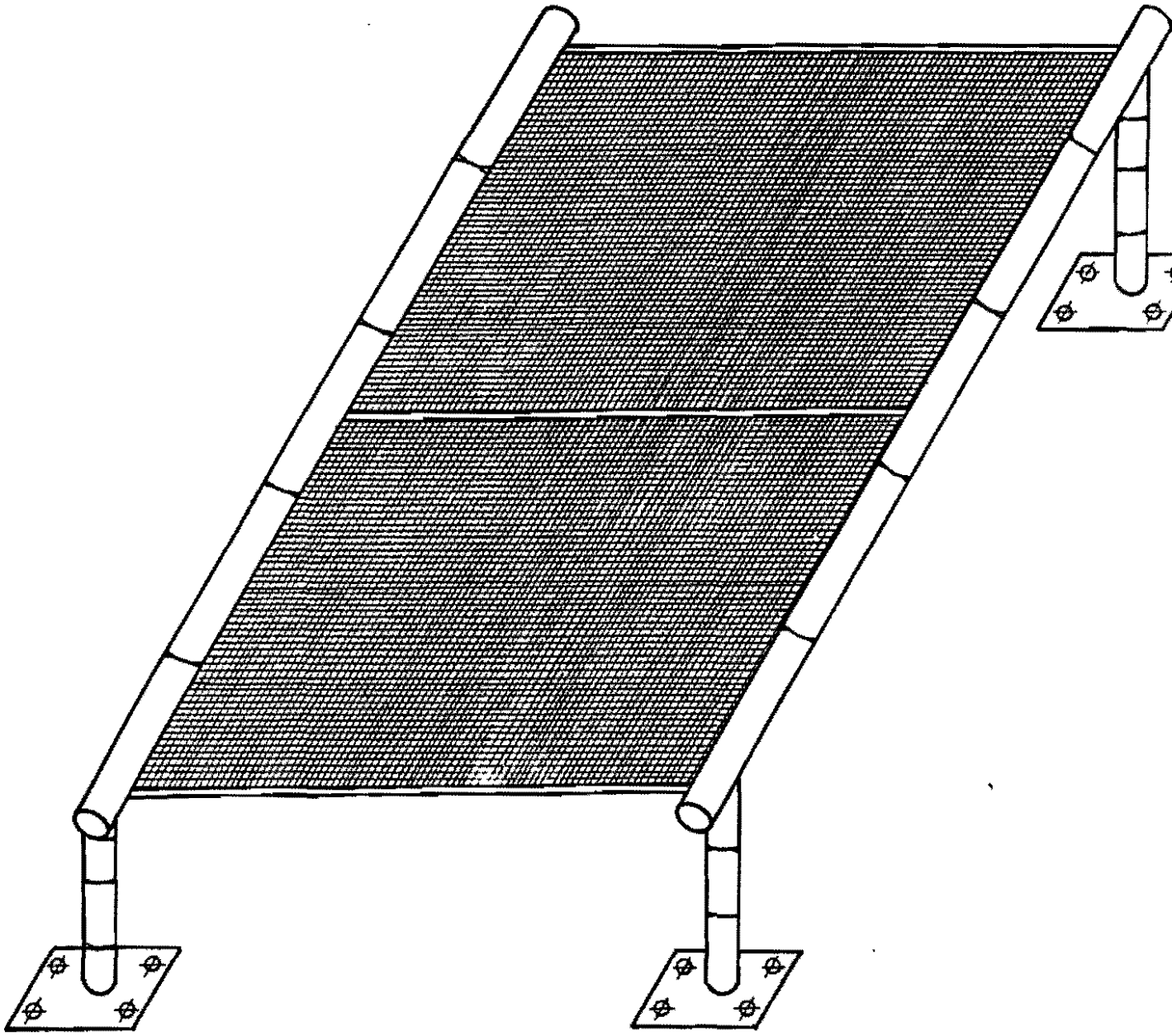
The channels receive starch milk directly from the screening machine (CATALOG No. 3) or vibrating sieve (CATALOG No 4). Because of their weigth, starch granules are deposited as the starch milk moves through the channels. In the final stage, the scum and remaining water are removed and the deposited starch collected for drying in the yard or on trays (CATALOG No. 7).

CHARACTERISTICS:

- Approximate volume: 7-10 m/min. (23-33 feet/min).
- The channels are made of brick, plastered with cement, and covered with small square tiles of porcelain or wood.
- Channel floors may be totally level or slightly inclined at 1-3 cm per 150 m (0.4-1.2 inches per 500 feet). Channels ends may be angular or curved.
- Channels are built at the same level as the cassava starch fermentation tanks or below.
- The design of the channels can be varied according to the capacity of the processing plant, for example:

CHARACTERISTICS	CAPACITY	
	10-20 tons/day	30 tons/day
Number of channels	7	5
Channel length	15-25 m	50-60 m
Total channel length	105-175 m	250-300 m
Channel width	30-40 cm	40-60 cm
Channel height	40-60 cm	40-60 cm
Starch milk volume	7-10 m/min.	7-10 m/min.
Channel incline	1-3 cm/150 m	1-3 cm/150 m

CASSAVA STARCH DRYING TRAY



CASSAVA STARCH DRYING TRAYS

CATALOG No. 7

OPERATING PRINCIPLE:

Wet cassava starch is collected from the fermentation tanks (CATALOG No. 5) or sedimentation channels (CATALOG No. 6) and sun-dried on trays made of guadua (building bamboo). Drying time depends on the climate of the area. Drying can also be artificial, using ovens, centrifuges or air chambers. Temperatures must not exceed 55 °C (131 °F), because otherwise the starch gelatinizes and loses its expansion properties.

CHARACTERISTICS:

The tray's framework may be built of guadua and the mesh of stainless steel, plastic or coarse linen. The whole may be supported by wooden columns or placed directly on the drying yard.

- Measurements are usually: **length:** 1.5-2.0 m, **width:** 1.0-2.0 m, and **thickness of spread:** 1.0-2.0 kg/m^2 of wet starch.
- The color and quality of the cassava starch depend on the amount of sunlight.
- Drying trays should have some sort of protection or roofing to prevent wetting by rain or contamination by wind.
- The starch should be turned over every 1-3 hours, either manually or mechanically to obtain a homogeneous drying.