

# Orange Cleaning, Sizing, and Sorting Machine



## Bill of Materials

16 ft	2"x 1"x 1/16 rectangular tubing	32 sq ft	1-1/2" x 9 gauge flat & expanded metal
12	3/4" pillow block bearings	2	4" butt hinges
2 ft	3/4" black pipe	12 ft	#40 chain
4 ft	3/8" all-thread	16 ft	#50 chain
6	washing brushes (salvaged)	2	#40-12 sprockets
4	1" stop rings	2	#40-30 sprockets
26	3/4" clam shell bearings	1	14 gauge table top (plus)
4	1" clam shell bearings	4	rollers-pipe & shaft
26	3/4" stop rings	10 bf	I"x 4" pine-divider
4	sponge rollers (26 sponges/rollers)	12 ft	1/4" cable
3	plastic pipe squeegees (salvaged)	4	cable clamps
2	2" flange (cast iron)		14 gauge steel for bin, conveyor, washer, sizer, water drains, guards.
10	#50-18 sprockets		carpet (salvaged)
2	#50 idler sprockets	15	panel adhesive tubes
1	#50-36 sprocket plastic pipe sizer (salvaged)	5	switches (salvaged)
12 ft	1" cold roll round stock	1	switch box, 15 gauge
36 ft	2" x 2" x 3/16 square tubing		wiring, outlets, electrical boxes, plastic conduit, etc. 1/2" plastic pipe, valve, cap, etc. for water system.
20 ft	conveyor belt with paddles 12" wide	1 gal	flat red oxide primer
18 ft	conveyor belt (table) 22" wide	1-1/2 gal	industrial gray enamel
1	3/4 H.P. electric motor		
2	1/3 H.P. electric motor		
12 ft	6" channel		
35 ft	3"x2"x 3/16 angle		
40 ft	2"x2"x 1/8 angle		
12 ft	2"x2"x 3/16 angle		
60 ft	3" channel		
40 ft	3/4" cold roll round stock		
6 sq ft	1/2" plate		
24 ft	1" x 1" x 1/8 angle		

## Features:

1. Bin dump
2. Washing system
3. Drying system
4. Sizing system
5. Sorting table

## Design

A packing machine operation set up for two people. Oranges will be cleaned, dried, sorted, and packaged. The speed of operation will be determined by the speed with which the oranges are dumped onto the washing brushes.

### Basic Design

The orange cleaning and sizing machine was designed for two people to operate with a minimum of moving parts. It is similar to one used at a packing house, but scaled down considerably. Some parts, such as the brushes, were obtained from a packing house repair station and were cut down to fit this unit.

Start by laying out 2-3" channels, 20 feet long on the floor. These channels will provide the bottom frame of the machine.

Clamp a piece of scrap angle to the far end of the frame to hold it at 56-1/2" width while working on the bin dump end. Weld another piece of 3" channel to the bin dump end (56-1/2" O.D.) and start to frame the supports for the dump system. Photo #2 shows several stages. The washing section is shown chained in place with temporary legs and the conveyor is pictured, again held up with chains, and temporary braces. The bin dump is used to tip a bin of oranges nearly upside down. It is tipped by means of a cable, chains, and sprocket system. The bin is tipped up until all oranges have run out, and then lowered.

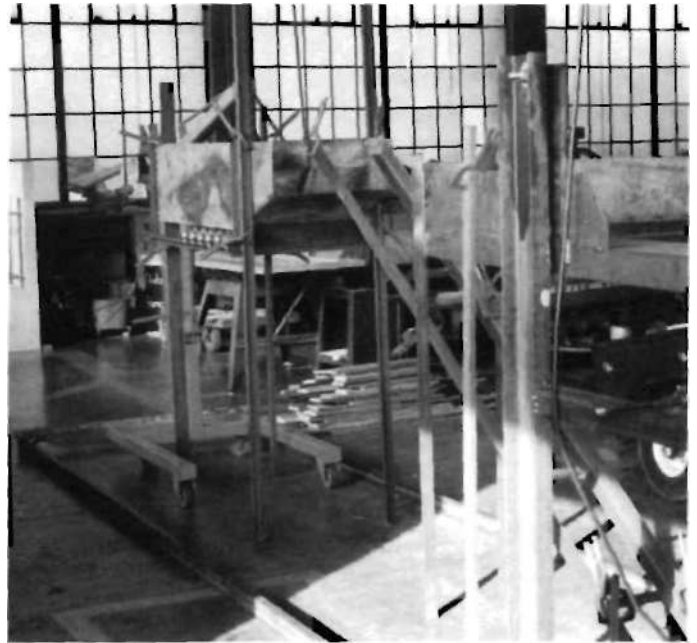
A side chute was added to allow dumping boxes of oranges instead of full bins.

The dump table pivots on 1" x 4" bolts. It is held in the tipped position by a spring loaded pin. It is framed with 2" x 3" x 3/16 angle, 3" long facing down, and is cradled on 1" bolts, pinned to 6" channel uprights. The bin dump will be raised and lowered by a cable system powered by a sprocket, and chain drive. Note the 3/4" shaft on pillow block bearings. This shaft will wind up a cable that in turn will tip the bin.

The side plates were 1/4" steel with 1/2" plate for the main uprights where the pivot pin will be.

The bin dump also has 2 cross braces made of 2" x 2" x 3/16 angle, 48" long, placed under the bin dump, and a 14 gauge strip of steel sheet 10" wide x 49" long, welded along each side of the dump. These strips will support the majority of the weight of the fruit bin.

The bin dump sits inside of a bin made of 14 gauge steel. When the bin is turned over the oranges will spill into the enclosed bin, and be carried up the conveyor to the washer unit. The bin has a sloping bottom so the oranges will roll into the conveyor. The sides of the bin are covered with 2-1/2 x 9 gauge expanded metal. The right side is welded into place in a frame of 1" x 1" x 1/8 angle. The left side is hinged to have access to the inside of the bin for cleaning.

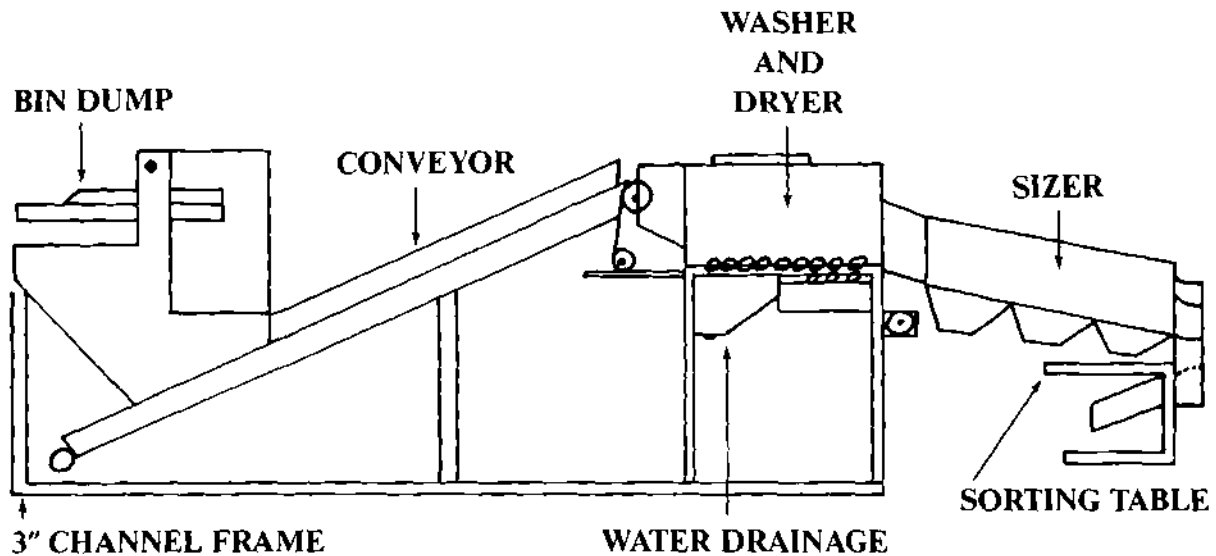


The door area is framed in 1" x 1" x 1/8 angle, and is hinged with two 4" bolts. The hinges are pinned with two 3/8" bolts.

The bin is raised by a crank which tightens a cable around a 3/4" shaft. A 12 tooth #40 sprocket is on the crank, and a 30 tooth #40 sprocket on the shaft. The shaft is mounted on 3/4" pillow block bearings at four points. Two extra bearings were used to ensure that the shaft would not bend under the weight of the bin of fruit. Washers were placed on the shaft to keep the cable in place.

As the pin is pulled, the bin is released, and can be cranked to the dump position. The pin will drop into another hole to hold the bin up in the fully dumped position.

The conveyor moves the oranges from the bin dump area to the washing area. It is set at approximately a 40 degree angle, and is made of 3" x 2" x 3/16 angle frame with 14 gauge steel sides. There are 3/4" shafts on each end, with 2-1/2" rollers. The rollers were made by cutting an 11" length of 2-1/2" block pipe. Plugs were made for the ends by cutting 3" diameter plugs 1/2" thick with a circle cutting oxygen-acetylene torch. A 3/4" hole was machined through the center of the plug. Four plugs were bolted together, and turned on a lathe until they fit the inside of the pipe. Cold roll 3/4" round steel cut to 20" was inserted as a shaft through the pipe, with a plug on each end. The plugs were pressed inside the pipe 1/2", and welded in place. Next the shaft was welded to the plug, thus making a roller that turns round, and true.



The washer unit was partially built on the table before being placed in the packing system.

The conveyor carries the oranges into the washing system where six brushes scrub the oranges, with the help of a water spray.

At this stage of construction the brushes and bearings are in place, and the legs can now be added to the washer unit. 2" x 2" x 1/8 angle iron was used for the legs, welded to 3" channel, across the bottom of the main frame of the machine.

All bearings are 3/4" clamshell type bushings spaced on 4 1/2" centers.

The use of squeegees under the sponges helps squeeze water out of the sponges. The tray that is clamped under the brushes will carry off the wash water.

Each roller has a sprocket (18 tooth) attached to the end of each shaft. One #50 chain turns all the sprockets at once, and drives the conveyor.

The chain is held against each sprocket by a 1" channel track. As the gear head motor pulls the chain, each sprocket is turned. An idler sprocket was placed at the end of the system to take up the slack on the chain, and to relieve the pulling pressure on the first bearing and shaft. The idler has a heavier bearing, and this can handle the side pull better than the clam shell bearings. A 3/4 H.P. gear head electric motor drives the entire system. The top side of chain is held in a 1" channel track. This keeps the chain from bouncing and vibrating. An idler sprocket was used to keep the chain tension tight.

This entire system of sprockets and chains is covered with a guard made of expanded metal, framed with 1"x T"x 1/8 angle.

The 3/4 H.P. electric motor is mounted to a 3/8" steel plate welded to the frame of washing unit. The plate measures 6" x 14", and is slotted to allow for motor adjustment.

As the oranges leave the washing unit, they drop onto a set of revolving rollers made of plastic pipe. These rollers turn toward the outside, causing the orange to travel downward until it finally falls through the rollers. These rollers will be turned by a 1/3 H.P. electric motor using #40 chain.

Three sizes of plastic pipe were used to give the sizer a tapered shape.

Each pipe is pinned to the next by roller pins, and capped on the end.

As the oranges fall through the sizer they are channeled four ways. The first small size drops straight down into boxes. The next two larger sizes drop onto the sorting belt, and a final large size will roll behind, and under the sorting table.

Chutes and dividers were made of 14 gauge steel, and were braced back to the main frame with 1-1/2" x 1-1/2" x 1/8 angle.

As the oranges leave the sorter they fall onto a conveyor table. The largest oranges roll behind, and under the table into boxes on the floor. The table was made with a 2" x 2" x 3/16 square tubing frame with a 14 gauge top.

Bearings were mounted on 2" x 2" x 1/8 angle.

The entire machine was primed with a flat red oxide paint, then sanded. Two coats of an industrial gray enamel paint were then applied.

AH surfaces that oranges would touch were covered with an indoor-outdoor type carpet. A panel adhesive was used to glue the carpet in place.