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 WASHINGTON, D. C. 20523
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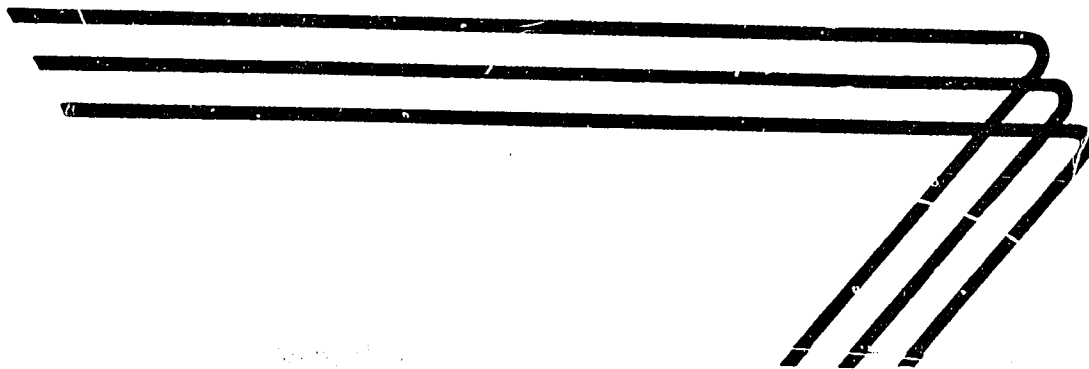
Batch 88

1. SUBJECT CLASSIFICATION	A. PRIMARY	Development and economics		DM00-0000-0000
	B. SECONDARY	Industries and industrialization		
2. TITLE AND SUBTITLE				
Plant requirements for manufacture of unfermented grape juice				
3. AUTHOR(S)				
(101) U.S. Dept. of Commerce. Office of Technical Services				
4. DOCUMENT DATE		5. NUMBER OF PAGES		6. ARC NUMBER
1956		11p: 12p.		ARC 641.875.I61
7. REFERENCE ORGANIZATION NAME AND ADDRESS				
AID/TA/OST				
8. SUPPLEMENTARY NOTES (<i>Sponsoring Organization, Publishers, Availability</i>)				
(Plant requirement no.63)				
9. ABSTRACT				

10. CONTROL NUMBER		11. PRICE OF DOCUMENT	
PN-AAF-733			
12. DESCRIPTORS		13. PROJECT NUMBER	
Beverages	Manufacturing		
Fruits	Requirements		
Grapes	Small scale industries	14. CONTRACT NUMBER	
Industrial plants		AID/TA/OST	
		15. TYPE OF DOCUMENT	

161

PLANT REQUIREMENTS FOR MANUFACTURE OF UNFERMENTED GRAPE JUICE



DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
COMMUNICATIONS RESOURCES DIVISION

Washington 25, D. C.



Reference Center
Room 1656 NS

FOREWORD

This brochure is one of a series of reports resulting from overseas technical inquiries on factory or commercial establishments, operation, management, and engineering. The report is designed to provide only a general picture of the factors that must be considered in establishing and operating a factory of this type. In most cases, plans for actual installations will require expert engineering and financial advice in order to meet specific local conditions.

Mention of the name of any firm, product, or process in this report is not to be considered a recommendation or an endorsement by the International Cooperation Administration, but merely a citation that is typical in its field.

Industrial reports prepared for ICA under special contract are customarily reviewed and edited before publication. This report, however, like other technical inquiry replies, has not been reviewed; it is the sole responsibility of the firm that prepared the report.

This brochure was prepared in April 1956 by the Office of Technical Services, U. S. Department of Commerce, Washington, D. C.

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For further information and assistance, contact should be made with the local Productivity Center, Industrial Institute, Servicio, or United States Operations Mission.

Code Number

63

UNFERMENTED GRAPE JUICE

INQUIRY: Information and plant requirements are requested for processing of fifteen tons of unfermented grape juice per day.

INFORMATION SUBMITTED:

Pressing juice out of grapes and processing the liquid into marketable grape juice requires, a) the most careful selection of equipment which can be operated economically for fifteen tons of grapes per day, b) maintaining the proper temperatures necessary for successful pasteurization, and c) adhering strictly to established standards of cleanliness and sanitation.

Observing the above conditions, the entire conversion process consists in its main outlines of the following steps:

The grapes are harvested and destemmed at the vines when the total soluble solids content is at least 18 percent, as estimated with a refractometer. They should not be green, nor should they be too ripe.

The grapes are washed, crushed, and slowly heated in a kettle to a temperature of 140 to 145° F. This technique releases color and acid, and greatly facilitates pressing. After pressing the juice is poured into jugs, or the so-called carboys, and stored 3 to 4 months for the deposition of sediments. (argols).

When this juice is ready to be bottled, the clear juice is siphoned off from the precipitated sludge, pumped through the pasteurizer and this time heated to 175° F to 185° F, and then bottled in pasteurized bottles.

In addition to the above pasteurization method of processing grapes, there are other known techniques, such as the preservation of juice by chemicals, the cold or freezing storage method, the filtering technique done with the aid of special germproof filters, storing the juice under high-pressure carbon dioxide gas, and the concentration of juice until the soluble solids are sufficient to effect preservation. However, only the preservation by heat and storage in jugs for the deposition of the sediments will be dealt with since this is the method mainly used in the U.S.

Washing of Grapes: (Item 2)* The grapes are received at the plant and placed in containers where they are fed through a powerful spray of water on a conveyor table. This enables a thorough washing of the grapes. (No automatic "destemming" machine is being considered with the equipment planned. However, space has been provided in the layout for such an installation in the future.)

* See diagram

Crusher: (Item 3) The conveyor empties the grapes into a roller crusher where they are reduced to a soft mass.

Kettle: (Item 4) From the crusher the grapes pass to a kettle in which the crushed mass is heated to 145 degrees F. This kettle is equipped with paddles for a quick and efficient mixing. As the rotating paddles mix the mass, the color and other solubles are extracted under the effect of heat and the whole material is converted into a fluid mass.

Press Cloths: (Item 5) This fluid mass is run into press cloths for pressing. Special racks (item 6) enable the operator to hold the press cloths in a frame, on a rack under the flow of the grape mass. One set of cloth-covered mass is laid on top of another until a fairly large number of layers (or "cheeses" as they are called) have been built up for transfer to the press. During the making of these "cheeses" as much as one-half or more of the juice drains out of the heated pulp. This free-run juice is usually lighter in color and contains less acid, but more sugar than that which is pressed out subsequently on the press. In certain plants, heavy weights are placed on the "cheeses" to allow certain settling, before they are transferred to the press.

"Cheese" Transfer to Press: This is effected with the aid of a single set of rails on which the operator delivers the mass to the press.

Screw Press: (Item 7) The "cheese" is now transferred from the rack to this machine. This is a manually-operated ratchet-type machine, in which the pressure is applied gradually until about 80 percent of the juice in the mass is squeezed out.

Holding Tank: (Item 8) As the juice is pressed out of the mass, it flows through pipes to a holding tank, glass lined, where blending the grape juice is effected.

Cloths Maintenance: As the press residue, or pomace, is removed, the cloths are shaken out and washed after each pressing operation, in a saline salt solution, dried and washed with clear water, and dried again.

Pasteurization: (Item 9) From the holding tanks, the grape juice is piped to the steam heated pasteurizer, operated at about 175 degrees F.

Storage: (Item 10) The pasteurized juice is placed in 5, 10, and 15 gallon jugs, and stored away for three months in a fairly cool place. Filling of the jugs is made right after sterilization and while the juice is hot. Thus, fermentation is prevented. It is necessary to bring the temperature

of the jugs up to that of the pasteurizer, this being done in ordinary steam boxes. Foam and solid particles which rise to the surface are allowed to flow over by filling the jugs with sufficient juice. The hot pasteurized juice may also be run into sterilized barrels, kept in a cool place and turned a little each day to prevent drying out of the upper staves.

Final Processing: (Item 11 (or 9)). In storage for three to four months, all sediments like argol and other matters settle on the bottom of the storage vessels and the finished grape juice can be siphoned off. After complete sedimentation, the juice is filtered and pasteurized a second time in the same machine and siphoned off into small bottles. Filtering is done with the aid of carbon filtering material and siphoning with the aid of a hand pump.

Other Methods: There are other methods of producing grape juice. However, the process described above is the most commonly used. Some manufacturers use various filtering processes or apply certain chemicals to preserve the juice. Some mix the hot pressed juice with cold pressed juice for special blends. Research is constant and never-ceasing to develop still more stable juices. The extent of this research, however, precludes detailed discussion in a review concerned with the most commonly used method known to produce good, tasty, and marketable juice.

Cost Estimate for Plant Requirements:

Spraying equipment, including 3 hp motor, spray nozzles, pump (for pressure up to 75 lbs.) valves, piping and tank to hold dirty water	\$ 650.00
Conveyor and pump unit for spraying equipment	400.00
Grape Crusher	1,000.00
Kettle, including piping for steam, valves, starter, temperature gage	2,500.00
Press cloths, including racks for holding cloths, tank for catching free-flowing juice, valves, piping	1,500.00
Racks	300.00
Cheese Transfer, including rails	150.00
Screw Press, ratchet type for hand operation	2,500.00
Holding Tank for juice, glass lined, including piping valves and set of filter cloths	1,000.00

Pasteurizer, including pump, motor, temperature controls, valves, starter	\$ 3,500.00
Storage Jugs, 5, 10, and 15 gal. capacities	500.00
Filtering Equipment	1,000.00
Siphoning Equipment	<u>300.00</u>
Total	\$ 26,647.84

General Equipment: There are no particular observations included in this study on such general equipment as the boiler, light and power, water and water pump and other auxiliaries. As standard items, these may be acquired more economically if bought on the local market.

Manpower Requirements:

1 General Superintendent, per year	\$ 6,000.00
1 Application Technician	4,000.00
1 Maintenance Man	4,000.00
1 Mechanic in Tool Room	3,500.00
8 Machine Operators	<u>16,000.00</u>
Approximate labor cost per year	\$ 33,500.00

Bibliography:

"Improvements in the Manufacture and Preservation of Grapejuice", Bulletin No. 676, and

"Low Temperature Preservation of Fruit Juice", Bulletin No. 743.

Both from the New York State Agricultural Experiment Station, Geneva, New York.

They present the results of studies of the various methods of preservation of grapejuice by pasteurization and various chemical preservatives.

"Deterioration of Processed Fruit Juices," Bulletin No. 728, New York State Agricultural Experiment Station, Geneva, New York. Bulletin describes observations made by the chemists of the chemical changes of fruit juices and how the same affect the sugar content, flavor and colors.

"The Chemical Composition of Ripe Concord-type Grapes," Bulletin No. 285, New York State Agricultural Experiment Station, Geneva, New York. Presents techniques employed to determine the amount and degree of the chemical constituents of grapes, and presents data obtained from numerous samples.

"Production of Juices," by the Canadian Department of Agriculture, Ottawa, Canada. Publication No. 813. Describes and illustrates the equipment and processes used in the manufacture of various juices, including those obtained from grapes.

"U.S. Standards for Grades of Frozen Grape Juice Concentrate for Grape Beverage", U.S. Department of Agriculture, Marketing Services (7 CFR, Part 52). Presents production description of frozen grape juice concentrates for the making of grape beverages, factors which influence quality, how to classify them and standard methods of analysis.

Supplement dated April 20, 1951, is the second issue dealing with the same problem.

"Recovery of Tartrates from Grape Wastes," AIC-14, by the Western Research Library, Albany, California, U.S. Department of Agriculture. Description of experiments to develop economical methods for the recovery of valuable constituents from grape wastes, with plans showing layout of processes.

"The Enzymic Clarification of Grape Juice", a reprint of Technical Bulletin No. 178, issued by the New York State Agricultural Experiment Station. A new method is described here for the clarification of grape juice with an enzyme which converts the pectin of grape juice into soluble substance.

"Menthyl Anthranilate in Grape Beverages and Flavors," from Industrial and Engineering Chemistry, Vol. 15, No. 7. Presents reasons why methyl anthranilate is of unusual value in grape-type products; and lists data of commercial product and how the flavors were affected through such examples.

"Recent Advances in Fruit Juice Production," by the Commonwealth Bureau of Horticulture and Plantation Crops, February 1950, Heavley Brothers, 109 Kingsway, London W.C. 2, England 15s. Describes and illustrates general developments in processes and bottling fruit juices, including grape juices in Canada and U.S.A., as well as fruit juice developments in some commonwealth countries.

"Canners Directory," by the National Canners Association, Washington 25, D.C. Presents list of members as well as makers of food machinery and supply companies and food brokers associations for the attention of plants able to export.

"Stabilizing Food Drinks," published at 33 Tothill Street, Westminster, London, S.W. 1, England. Articles explain latest methods and list technical abstracts and plant requirements for processing.

Equipment Suppliers:

Niagara Filters Division
American Machine and Metals, Inc.
East Moline, Illinois
(Makers of small and large juice filters)

Food Machinery and Chemical Corp.
Hoopeston, Ill.
(Food processing equipment, materials handling machinery and packaging units)

Chisholm-Ryder Co.
Niagara Falls, N.Y.
(Makers of food processing and juice extracting equipment)

E. W. Bliss Company
50 Church Street
New York 7, N.Y.
(Hydraulic and screw presses)

Waukesha Foundry Company
Waukesha, Wisconsin
(Stainless Steel Pumps)

Horix Manufacturing Co.
Pittsburgh 4, Pa.
(Complete line of bottling machinery)

Minneapolis-Honeywell Mfg. Co.
Philadelphia 44, Pa.
(Complete line of gages and instruments)

The Creamery Package Mfg. Co.
1200 West Washington Blvd.
Chicago 7, Ill.
(Makers of heating, cooling, holding and pasteurizing equipment)

Hamilton Copper and Brass Works
820 State Avenue
Cincinnati 4, Ohio
(Complete line of stainless steel kettles)

F. H. Langsenkamp
227-235 East South Street
Indianapolis 25, Indiana
(Washers, juice extractors and strainers)

The Pfaudler Company
Rochester 3, New York
(Filling Equipment and Vacuum
Evaporators)

Berlin-Chapman Company
Berlin, Wisconsin
(Juice Extractors, Washers
and Heating Tanks)

The Diversey Corporation
1820 Roscoe Street
Chicago 13, Illinois
(Builders of sanitation equip-
ment for Food Shops)

Mogonnier Brothers Company
4601 West Ohio Street
Chicago 44, Illinois
(Pasteurising equipment)

Sources for General Information on All Phases of Food Processing:

National Cannery Association
1133 20th Street, N.W.
Washington 6, D. C.

Western Canner and Packer
121 Second Street
San Francisco 5, California

Cornell University Agricultural Experiment Station
Ithaca, New York

Institute of Food Technologists
11600 South Bell Avenue
Chicago 43, Illinois

The Avi Publishing Company, Inc.
30 Union Square
New York 3, New York

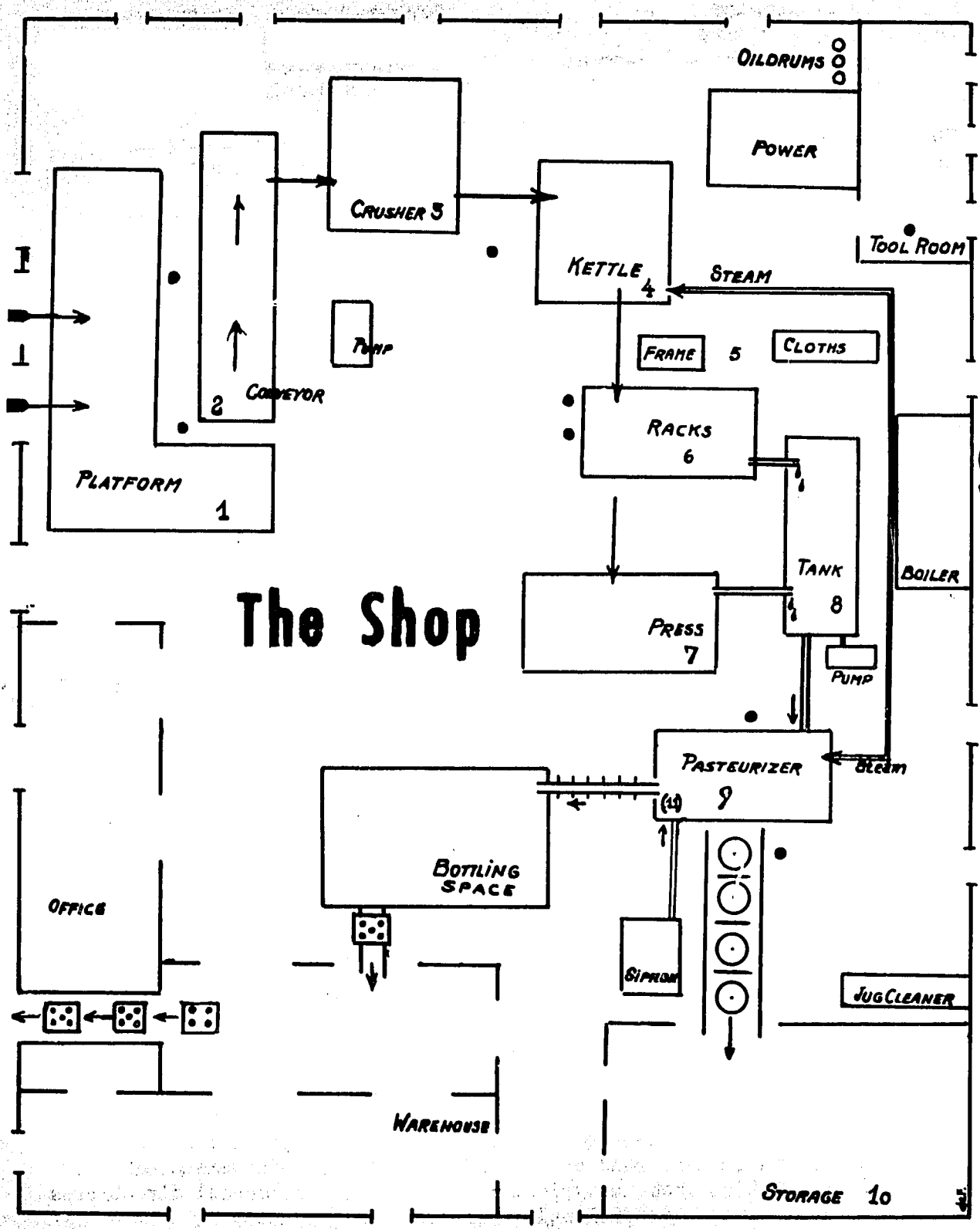
(Publishers of The Chemistry and Technology of Fruit
and Vegetable Juice Production. Volume also contains
an excellent chapter on the latest improvements in
grape juice industry in the U.S.)

Commercial Fruit and Vegetable Products (3rd edition)
by Dr. W. V. Cruess. Pub. by McGraw-Hill Book Co.,
Inc., New York and London.

A Complete Course in Canning (7th edition). Published
by the Canning Trade, 20 South Clay Street, Baltimore
2, Md.

Mention of the name of any firm, product, or process in this report is not to be construed as a recommendation or endorsement but merely as a citation that is typical in its field. Commercial directories generally list names of additional companies and products.

NOTE: To obtain copies of any catalogs, bulletins, and other reference material mentioned in this report, please write directly to the indicated source of supply.



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