...NT REQUIREMENTS FOR MANUFACTURE OF CANDY AND CONFECTIONERY

TECHNICAL AIDS BRANCH
INTERNATIONAL COOPERATION ADMINISTRATION
Washington, D. C.

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 September 1957 by the Wolf Management Engineering Company, Chicago, Illinois.

* * * * * *

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

Code Number
44

TABLE OF CONTENTS

CANDY AND CONFECTIONERY

CANDY ORIGIN AND USAGE

Candies and confectioneries probably had their origin at the beginning of civilization when the ancients discovered they could satisfy the natural chemical requirements of the human body for carbohydrates or sugars through the use of honey or saps of certain leguminous plants, trees, herbs, fruits and other forms of vegetation.

With the evolution and progress of mankind, certain plant life was cultivated and developed to produce sugars and syrups. Along with such development, candies and confections undoubtedly came into popular use.

Today they comprise a major industry in most parts of the world. The per capita consumption of candy in the United States alone during 1956 was approximately 17.4 lbs. Total annual output of amost 3,000,000,000 lbs. required 1,434 plants employing 66,800 persons.

Among the more than 30 food processing industries in the United States, the candy industry ranks sixth in employees and payroll and ninth in the wholesale value of products.

THE CANDY INDUSTRY

Candy and confectionery manufacturers are generally divided into two groups, (1) manufacturers, including wholesalers, and (2) retailers. The manufacturer-wholesalers are the mass producers of the candy industry whose goods (solid or chocolate covered bars and various kinds of hard, filled, covered and not covered candy) are produced in substantial plants which, to a large degree, are mechanized. Their goods are usually sold to jobbers, chain stores, brokers, etc.

The manufacturer-retailers compose the smaller segment of the industry. They produce mostly boxed chocolate, coated cream candies, better grades of hard candy, etc. Their plants are medium or small in size and are sometimes known as "candy kitchens," and they sell their production direct to the consumer in their own stores. Mechanization of production departments in such plants is, of course, much less pronounced.

It is suggested that any projected candy plant begin on a modest scale. This not only reduces the financial risks involved in starting a new candy enterprise, but also enables the potential operator and his staff to gain essential experience regarding local tastes, markets and climatic influences.

This report deals with a modified form of manufacturer-retailer, that is, a small firm producing, with a minimum of mechanization, chiefly medium-priced coated and packaged candy to be sold in its own store. It also makes a line of inexpensive hard candy and distributes it wholesale through other sales outlets and agents. Gradual expansion would start from here.

REQUISITES OF SUCCESSFUL CONFECTIONERY MANUFACTURING

The success of a confectionery business depends to a large extent upon the operator's ability to produce, at a profit, candy which meets his customer's particular taste and at the same time fits his pocketbook.

This requires from the potential operator:

1. Knowledge about the market he expects to serve;

2. Information and statistics on raw material prices and fluctuations and their influence on the finished candy product. (This is important when 50-70% of most candy sales prices must pay for the ingredients.)

3. Knowledge as to the investment required for production facilities and operations for a modest enterprise of the scope assumed;

4. Candy recipes suitable for the market from the point of view of customer sales and effect of climate on raw material and finished candy.

5. Knowledge about the actions of ingredients and the changes which occur in them while they go through the cooking process, the sequence in which they are added to the batch being cooked, and reactions in finished candy;

6. Knowledge of different methods of casting, forming and coating candy;

7. Information about economy and techniques of different packing, boxing, and distribution methods.

In this report, the abovementioned areas can be covered in only a general way. It is recommended that the prospective investor obtain technical data on candy manufacture from the sources named in the bibliography at the end of this report.

The prospective investor is cautioned to obtain the services of a reputable firm of consulting management engineers who would prepare a complete analysis of administrative, operative and financial problems as they relate to specific localities and conditions before the candy manufacturing enterprise is begun.

PRINCIPAL RAW MATERIALS AND THEIR CHARACTERISTICS

Sugar

Ordinarily, candy makers use sugar produced from sugar cane or beets, but some, mostly in the United States and Canada, use maple sugar to impart a special flavor to certain candies.

The candy plant operator should know the uses of the following different kinds of granulated sugars:

Medium -- for tray sanding, bonbon coating, fondant, clear hard candies, crystal syrup.

Fine -- for sugar cream mints, fountain syrups, sanding on slabs, for coconut candy, etc.

Baker -- is added to toffies or butter crunch after cooking so that the graining process will start. It is used by many for making jelly beans and other soft pan goods.

Powdered -- icings, dusting of candy.

Special attention is required when using yellow and brown sugars, since they easily become hard when the moisture evaporates. Yellow and brown sugars should be dissolved in hot water before adding dry white sugar to avoid the presence of undissolved crystals even after the candy batch has been cooled.

Molasses

There are three preferred classes of molasses in the candy industry in the United States, (1) Louisiana choice, (2) reboiled Louisiana choice, and (3) Louisiana prime molasses.

The popularity, as a candy ingredient, of molasses or its blends varies according to local tastes or local confectionery selling prices.

Corn Syrup (Glucose)

Corn syrup has a marked effect on the ingredient cost of candy made with this sweetening agent. Its effect in retarding the graining of sugar is also pronounced. The softness of cream candies, for example, is governed by the amount of corn syrup used. Too much of it produces tough creams.

Those hard candies which are made with low cooking temperatures should contain more corn syrup, though the percentage must be carefully watched to prevent sticking.

It is interesting to note, particularly from an ingredient-cost point of view, that larger percentages of corn syrup can be used in vacuum cooked hard candy, since while cooking at low temperatures, much moisture is removed by vacuum. However, vacuum equipment should be acquired only when the enterprise is firmly established.

Corn Sugar (Dextrose)

Corn sugar generally is used to a greater extent by manufacturer-wholesalers than by manufacturer-retailers. It replaces a part of the sugar in nougats, starch jellies, and chewy candies. Candy made with a combination of the sweetening agents mentioned so far, especially if corn sugar is included, will flow more easily.

Invertase

Invertase, which is made from yeast, converts sugar into invert sugar. Invert sugar is an inverting agent which increases the syrup density in candy. It should not be above 165° F. when added to batches, since excess heat reduces its effect. For the same reason, it should not be in direct contact with the kettle.

Invertase actually supplements the work of invert sugar by softening creams after they are chocolate coated or by increasing syrup density in creams. The chocolate coated creams surrounding dipped fruit will become liquid quicker when invertase is added to the fondant. Since cast fruit usually contains more fondant than dipped fruit, the amount of invertase must be proportioned accordingly to assure soft cordial cream fruits. The same care must be taken when the moisture contents of fruits vary. (High moisture -- less invertase)

One of the important benefits in the use of invertase is that creams may be produced weeks before they are needed for sale. This permits better utilization of the equipment, and the candy will be fully softened in approximately two weeks.

Invert Sugar

Sugar which has been treated with acid or invertase is called invert sugar. It is thus changed from a dry to a moist sugar. When maximum sweetness is required, invert sugar replaces corn syrup.

Apart from its function as a moistening agent, invert sugar, when cooked in a batch of candy, is used also to control inversion of the sugar in this batch. It helps to retard fermentation in chocolate coated creams, especially when used with invertase.

Invert sugar has many of the same qualities of invertase. Thus, when combined with sugar, it inverts the fondant of dipped fruit most speedily. When added to creams after they are cooked, invert sugar retains moisture (especially important for hand-rolled creams) without inverting sugar as much as if it were cooked in the candy batch. This also aids in making the cream softer.

Since hard candy is probably the first candy to be produced in a new plant, it is interesting to note that hard candy made from sugar and invert sugar has a higher gloss, is more tender and spins easier than hard candy made with sugar and corn syrup.

Cornstarch

Powdered starch is used as an aid in molding candy. Molding starch containing a small percentage of oil gives a more firm impression than the standard and usually very dry starch. However, dry starch is sufficient for dusting trays, tables and candies.

For cooking purposes, cornstarch comes in various jelling strengths and forms. Depending upon the recipes used, the plant operator must order the proper grade from his suppliers.

Honey

Very brief mention must be made of this important sweetener. When cooled in a batch with sugar, honey will invert some of the sugar and slow down crystallization. Honey is used in high-priced nougats where the honey flavor is desired by the discriminating candy eater.

Acid

Various acids used in candy are mentioned throughout this report. However, a special short paragraph should be reserved for this candy ingredient if only to indicate the importance of knowing how to mix a candy batch and what chemical reactions are to be watched for. It may mean profit or loss to the candy plant operator.

As the reader will have noted in the preceding paragraphs, acid helps to control inversion in sugar and starch. A later paragraph indicates how acids also bring out and fortify the true fruit flavor in candies where fruit flavors are used.

Citric acid - made from lemon, limes and oranges, also made synthetically. It helps to reduce consistency of starch jellies and also to clear the batch. It is used in hard, cream and jelly candy to bring out fruit flavor, especially citrus. It is important to use the proper quantity at all times.

Cream of tartar - generally made from grape juice. It is widely used to control crystallization of sugar in hard candies and fondant. It is undoubtedly the most popular inverting agent in the industry today.

Tartaric acid - used almost like citric acid but, because of its strength, in smaller quantities. It is used as a flavor fortifier in those candies calling for berry flavor.

Phosphoric acid - even stronger than citric acid but less tart, which makes its use more desirable with pectin jellies.

Acetic acid - used in fondants to control crystallization of sugar. However, invert sugar, being a more uniform control factor, has nearly replaced the use of this acid.

Chocolate

It is assumed that the potential candy plant operator, for whom this report is intended, will purchase refined chocolate, since processing of the cocoa bean requires considerable capital investment, much experience and a very substantial daily production to be economical.

A term used by chocolate makers requires special mention, since it explains important points about the texture of chocolate as well as gloss and shelf life of candies. The term is "temper." It refers to the condition of chocolate coating which has been cooled to below 92° F., while being agitated until the cocoa butter fats have crystallized.

In practical terms this means that cocoa butter is made up of fat particles of varying melting points. These crystallized fractions of fat are called "seed" by candy makers. When cocoa butter temperature drops to below 92°F., crystals form and act as seed upon which other fat fractions crystallize. These may develop three to four crystal formations, though only one formation will insure good shelf life and gloss for a coated candy.

This one formation is assured by slow cooling of the chocolate and continued agitation. Thus, the seeds are evenly distributed throughout the coating, giving a good finish. At least 85% of the fats must be crystallized in the dipping or cooling process if the candy is to be of acceptable quality. The 15% fat remaining will crystallize in 24 hours, if the candy is properly stored (68°F. or less).

Dairy Butter

While other fats and oils are used in candy manufacturing, dairy butter has general use, because of its delicate flavor, in such candies as nut brittles and cream centers.

Some recipes call for salted butter, others for sweet butter.

The candy maker should watch butter for rancidity which develops due to oxidation. If large quantities of butter are used, an anti-oxidant should be added to the butter, and the butter should be cooked with the batch. Otherwise, the candy will lose its shelf life after two weeks. To be extra safe against rancidity, it is suggested the batch, with the butter included, be cooked up to at least 250°F., then reduced with water to a lower temperature, and finished at the required temperature.

Fats and Oils

Referred to here are vegetable fats and oils ranging from the high melting point types of hard butter to liquid corn oil. The low melting oils and fats are used mostly for roasting nuts. Hard butter is used in caramel, nougat, and chewy candy. Between the hard butter and the low melting natural oils (for instance coconut oil) there are the so-called plastic butters with a soft body. They are made of hydrogenated oil resulting in a creamy texture. (melting from 96-110°F.). Plastic butter has many uses, such as in icings, in low priced creams to replace dairy butter, in chocolate paste combined with soft butter, in soft candy when fat but not dairy butter favor is needed, and in toffees and brittles to replace part of the dairy butter.

Extra good mixing and cooking to a low temperature are important where vegetable oils and fats are used in a batch. This will prevent graining when spreading the mix on the cold slab (when too hot, vegetable butter and chocolate butter in chocolate pastes will separate upon rapid cooling).

Anti-Oxidants

Candy containing fats becomes rancid due to oxidation of the fats. The oxidation in animal fats is quicker and stronger than in vegetable fat. Among anti-oxidants added to counteract rancidity are oat flour, brewer's yeast, glycerin and lecithin. Most of these can be added when flavor is added to the batch. Lecithin retards rancidity, since it aids emulsification of fat and the moisture in the batch, thus preventing separation of fats.

Lecithin

Lecithin requires special mention, since, besides being an anti-oxidant, it has additional qualities and functions. It improves candy's tenderness and gloss, as it aids even distribution of the fats. To some degree it prevents the growth of mold, which may form between the center and coating of uncooked candy when it is made of fresh dairy cream and chocolate.

Since mold forms on most surfaces and near acids, lecithin emulsifies the moisture in the center with fats in the creamed chocolate (containing natural acids). Hence, less moisture can leave the center, retarding the danger of mold formation between the center and the coating. Lecithin acts as chocolate coat thinner in place of cocoa butter but only up to a certain ratio.

Companies producing anti-oxidant chemicals to retard rancidity, as well as producers of lecithin, can supply detailed information as to the proper use of anti-oxidants in the candy factory.

Milk Products

The importance of milk products in candy making varies with the type of candy made. In the production of fudge and caramel, for instance, milk products play an important part. Texture and shelf life are determined by the quantity of milk products added and the manner in which they are cooked. The cooking action itself varies with the type of milk product chosen for the candy. While steam cooking is generally more satisfactory than open-fire cooking, the latter is used with good results.

The addition of stabilizers to increase the smoothness of milk products should be mentioned. Also, the stabilizer, if added in sufficient quantity, overcomes sourness in milk and cream and prevents curdling. Normally,

one ounce is used for every nine to ten pounds of milk solids (exclusive of fats). The most widely used stabilizers are ammonium carbonate, sodium carbonate and calcium oxide. For even distribution in the candy batch, they should be added to the milk before the latter is added to the candy batch.

There are many milk products in use in the candy industry. The table on the following page should give a picture of the general chemistry of each and the points to watch in the cooking process. Should the milk product for which the formula calls be unavailable, this table will serve as a guide for replacing it with another milk product.

The candy plant operator will undoubtedly use and rely very much on condensed solid milk pastes. They are, in fact, milk or cream in concentrated form. They are easy to store, seldom become rancid, and refrigeration is optional. Concentrated cream is high in dairy fat, low in moisture content, and about right in non-fat milk solids.

Concentrated milk contains a high amount of milk solids, is not high in vegetable and dairy fat content, contains some sugar or corn syrup and has a low moisture content. It is because of this low moisture content that these pastes may be added near the end of the cooking process, further simplifying the process.

Egg Albumen

All aerated candy, such as nougats and frappés for cream candy, use egg or soy albumen to give the whipping quality needed.

There are fresh, frozen or dry albumen products available. Where dry albumen is used, the batch is cooled to a lesser degree, since the albumen can be soaked in just the right amount of water. The quantity of albumen used is found in each candy recipe. There are formulas for replacing the various types of albumen with each other.

Flavors and Fruits

Besides the sweet taste of candy, the particular flavor of the candy is undoubtedly its most outstanding characteristic. It is therefore important that the potential candy plant operator be properly advised as to which flavor (and in what form) to use for the particular candy he wishes to produce. Only the best quality flavor should be used. Producers of the various types of flavors are always prepared to advise the candy plant operator.

MILK PRODUCTS COMPOSITION AND USAGE IN CANDY MAKING

Kind	Butter Fat	Milk Solids (Not Fat)	Sugar (Sucrose)	Water Lbs.	Weight Lbs. Per Gallon	Usage	Suitable For Open Fire Cooking Yes	No	Remarks
Skim milk	0%	9%	0%	91%	8.6	Flavor value	X		Fat deficiency reduced by adding vegetable butter.
Whole milk	3.5	8.5	0	88	8.5	- -	X		- -
12% cream	12	7.8	0	80.2	8.5	Type of cream selected depends on quantity of milk solids required (without fat)	X		- -
20% cream	20	7.1	0	72.9	8.5	" " " Good for stand-up caramel and homemade type fudge.	X		Milk solids (without fat) increased by replacing cream with evaporated milk.
25% cream	25	6.7	0	66.3	8.45	- -	X		- -
30% cream	30	6.2	0	63.8	8.4	Most widely used.	X		In caramel combined with evaporated milk.
35% cream	35	5.8	0	59.2	8.35	- -	X		- -
40% cream	40	5.4	0	54.6	8.3	Used only when high butter content is needed.	X		
Evaporated whole milk	8	20	0	72	9	Add to batch slowly. Use stabilizer. Curdles if not careful.	X		Unsweetened. When heated, becomes thicker and creamy looking; thickened by use of steam.
Sweetened skim condensed	0	28	43	29	11	- -		X	- -
Sweetened whole condensed	8	20	41	31	11	Excellent for rich fudge and caramels (with corn syrup and fats)		X	Careful cooking, good mixing for even distribution of sugar particles. When mixed with other milk products (except skim milk) gives extra good texture to finished candy.
Dry whole milk powder	27	71	0	2	-	- -			- -
Dry skim milk powder	1	97	0	2	-	- -			- -

There are four forms of flavor in use:

1. The Artificial Flavors

These are generally used in candy where large quantities of tree fruit concentrates cannot be used. They are, in fact, a combination of aromatic chemicals which try to match natural flavors and aromas.

It is important to use only the proper artificial flavor, since, for instance, when a flavor intended for soft candy is used in hard candy it loses valuable ingredients due to evaporation through the high cooking process. The flavor is improved by adding a small quantity of acidulent citric acid for citrus type flavors or tartaric acid for berry flavors.

2. Synthetic Flavors

These are combinations of elements mixed to match natural flavors, such as vanilla.

3. True Fruit Flavors

These are concentrates of the fruit itself. Alcohol may be used as the extracting agent but is not always used. True fruit flavors are needed in large quantities if the candy batch is to be fully flavored. They, too, are improved by adding an acidulent.

The fruit itself is used principally in puree form or as whole or sections of fruit as is the case with cherries and pineapple. It should be noted that fruit contains a percentage of acid which, during cooking with the batch, retards the graining of the batch.

It is assumed that the potential candy plant operator will buy flavors of all kinds from supply houses. Should large quantities of fruit be locally available and the candy market call for such fruit in candied or chocolate dipped form, methods for preparing the fruit may be obtained from the sources given in the bibliography at the end of this report.

4. Essential Oils

Oils are extracted from plants or fruit by distillation or pressure, and they have the distinctive odor of the plant or fruit from which they are derived. When these oils, in emulsified form, are added to candy, they produce flavor of the finest smoothness and mildness.

Pectin

Pectin is the substance which makes jellies congeal and set. It is contained in fruits in varying quantities, and it is often used in jelly candy in concentrated powder form together with real or artificial flavors, depending on the quality of candy to be produced.

Gelatin

Gelatin is a whipping agent and is often used with egg albumen to improve the tenderness of the product. There are quick-setting and slow-setting gelatins available, the latter being more stretchy and more economical in use. Gelatin is used in varying quantities in caramel kisses, nougats, marshmallows and other candies. It is essential to use only the best grade gelatin available.

Gums

Gums are used as binding agents to hold ingredients together. They are used in hard pan goods for coating nuts so that the nuts will retain their natural oil, and they give a hard base on which the sugar coating may be applied later. Also, hard candy that is to be sugar rolled may be wet with a gum solution.

For soft pan candy, such as jelly beans and marshmallow eggs, gums are used as a binding agent for the syrup. In cherry cordials, they are used to stiffen the wall around the syrup center. The essential oil emulsions mentioned earlier are easily held in suspension using gums.

Glycerin

Glycerin is of importance to the candy maker as moisture retainer and retarder of mold growth, especially in chocolates which are a mixture of sweet chocolate and dairy cream.

Nuts, Dates and Coconut

Most of the candy ingredients described so far are economical to the beginner candy plant operator only if he can purchase them from supply houses at low unit cost. Dates and especially nuts possibly will be grown in the areas for whieh this report is intended. Since their processing can be carried out with relatively small investments, the processing and use of nuts for candy will be described in more detail in this report.

Generally, shelled nuts require the following preparations before they become useful to the candy plant operator:

Select - by size or quality. This differs with country and type of nut.
Clean - remove foreign or inorganic matter, usually by hand.
Blend - various sizes or kinds of candy may require mixing for a particular candy product.
Blanch - this is described under "Almonds" below and is generally acceptable to all types of nuts.
Roast - usually in vegetable fat (sometimes also completely dry), such as coconut oil, peanut oil, corn oil, in gas-fired roasters.

The following table may be a general guide for roasting time at 300°F.:

Nut Type	Minutes
Cashew	10
Hazel (Blanched)	5
Almonds (Unblanched)	11
Almonds (Blanched)	8
Pecan	2.5
Peanuts	10-15
Pistachio	1.5

Note: Brazil nuts and walnuts are not roasted.
Blanching may at times follow roasting. This is done quickest by slight moistening of nut skin, followed by rapid drying.

Cool - usually on a screen table under which suction fans are mounted.

Grinding, slicing, salting or other steps may follow.

Not enough mention can be made regarding proper storage and treatment of nuts to prevent rancidity, damage from insects, or absorption of odors. The United States Department of Agriculture and numerous chemical and cold storage manufacturers have more detailed information available on this important subject than the scope of this report permits. As a general rule, buy and store nuts in the smallest quantity practical.

Peanuts

Peanuts in the candy industry are coated or used as decorations or in the form of peanut butter. The most popular peanut candy is probably peanut brittle. It is important to use only clean shelled peanuts. Since this nut has a high oil content, great care must be given to prevent rancidity. Peanuts should be stored in clean, cool rooms (not too damp) to prevent odor absorption.

Almonds

Predominently hard shelled sweet almonds are used in the candy industry. This nut is flavorful both unroasted and roasted. The roasted nuts are used in hard candy, chocolate coated candy and others. Unroasted they are used for creamed almonds, in nougats and for decorations.

In blanching almonds, the best results may be obtained by placing them in hot water and raising the temperature to 195°F. for four minutes. The nuts are removed, scalded and blanched by hand or machine in small quantities at a time, then dried below 140°. Too much moisture makes the nut tough.

Cashew Nuts

This nut is a seed of a fruit. It is dried and roasted in the locality where it is produced. Cashew nuts are often treated with gas to prevent insect infestation. (Worms can be easily detected by a hole in the nut surrounded by a web or dust.)

Before use in candy, the nut should be dry roasted to bring out a mild sweet taste. Scorched ones can often be mixed into candy batches.

Hazel Nuts (Filberts)

This nut is stronger in flavor than most others and should be slightly roasted before use with candy to bring out the flavor fully. Mixed with cashews this nut is extra tasty. The crushed hazel nut when mixed with sugar makes a paste which is popularly used in coated truffle style candy. For this, the paste is usually mixed with coconut oil and chocolate. The paste is also used as bonbon centers.

Pecan

Since this nut is usually higher priced than others, only top quality should be bought, and shriveled nuts should be rejected as they are lacking in flavor and fat content. Its great popularity justifies its higher price to a certain extent.

Pecans keep their flavor well when stored at 32°F. and 68% relative humidity. This also aids in preventing damage from insects. The storage room must be odor free, and great care should be taken to prevent ammonia spoilage.

Rancidity of unshelled pecans may be retarded for approximately six months by heating them in a hot air oven up to 176°F. or in oil at 176°F. followed by cooling to 82°F.

Pishtachio Nut

This greenish colored nut is a must in good quality nougat. It is also used in fine nut candy, for decorations on bonbons and for French chocolate coating.

Walnut

After removal from the hulls and cleaning and drying, walnuts are graded by color and size. The darker colored ones are mixed into candy batches, and the lighter ones are used where they are visible.

Brazil Nut

This nut is the seed of a tropical fruit tree. The seeds are separated from the fruit before shipment.

Proper storing is important for this nut because of its high fat content and danger of rancidity, though the danger of rancidity is less with the whole nuts. Sliced Brazil nuts are used in many candies and as decoration for fudge. Blanched and chopped, they are used as outer coating for nut rolls, etc.

Dates

For stuffed uncoated dates, the light colored variety is usually selected because this fruit is firmer. Darker dates can be used when chocolate coated.

Coconut

Coconut has wide and varied uses in the candy factory. It is used in the form of dry coconut. When sweetened and cut in one of many possible ways and sizes, it is used for rolling candy, in macaroons and fudge, or as decoration. In unsweetened form, it is often colored and used as decoration. The tenderness of dry coconut can be increased by making a one to eight mixture of invert sugar and coconut and adding one pint of warm water for each eight pounds of coconut.

Creamed coconut, the emulsified coconut meat with all the oils and solids of the fresh nut, is another form in which this nut is used. It gives a most delicious flavor to candy. It also can be used to replace coconut oil and can be used in icings. Its pleasant taste can be found in caramels, butterscotch and nougats, depending on the taste of the local market.

Fresh coconut is of course the most tasty variety. It may be used alone or mixed with dry coconut. It should be cooked before it is added to cream candy to prevent fermentation. When used with ungrained candy, the candy batch should be removed from heat as quickly as possible and cooled quickly to prevent discoloring of the nut.

MANUFACTURING PROCESSES OF BASIC TYPES OF CANDY

Good ingredients alone will not make salable candy. Manufacturing know-how, efficient methods, and proper formulas (recipes) are also needed to produce candy suitable for the tastes and climate of the market to be served. Certain basic information about the processes and equipment required to make the major types of candy will be outlined here. The reader may find it helpful to refer again to the section on raw materials in order to review their purpose, characteristics and reactions in the batch.

It should be noted that in the beginning enterprise, the candy will be made in batches. The continuous method of making candy is economical and advantageous only where sales volume is large; it should not be considered until the larger production can be marketed.

The Fondant Candies (Creams)

Chocolate coated cast or hand rolled creams, crystallized creams, bonbons and slab creams or fudge where the candy body is creamy all belong in this group. The fondant is the basis of all cream candies and is made up of sugar crystals surrounded by a noncrystalline syrup. The proper texture is achieved by prolonged cooking (Figure 1) to about 226°F. of sugar with excessive amounts of water or acids added. Part of the sugar, thus inverted, will control recrystallization of the remaining sugar. Also, invert sugar is used.

After partial cooling, the liquid is agitated in the cream beater (Figure 2) at about 110°F., thus becoming creamy. Just before the batch is fully creamed, flavors or fruits are added in accordance with the type and flavor of fondant candy desired.

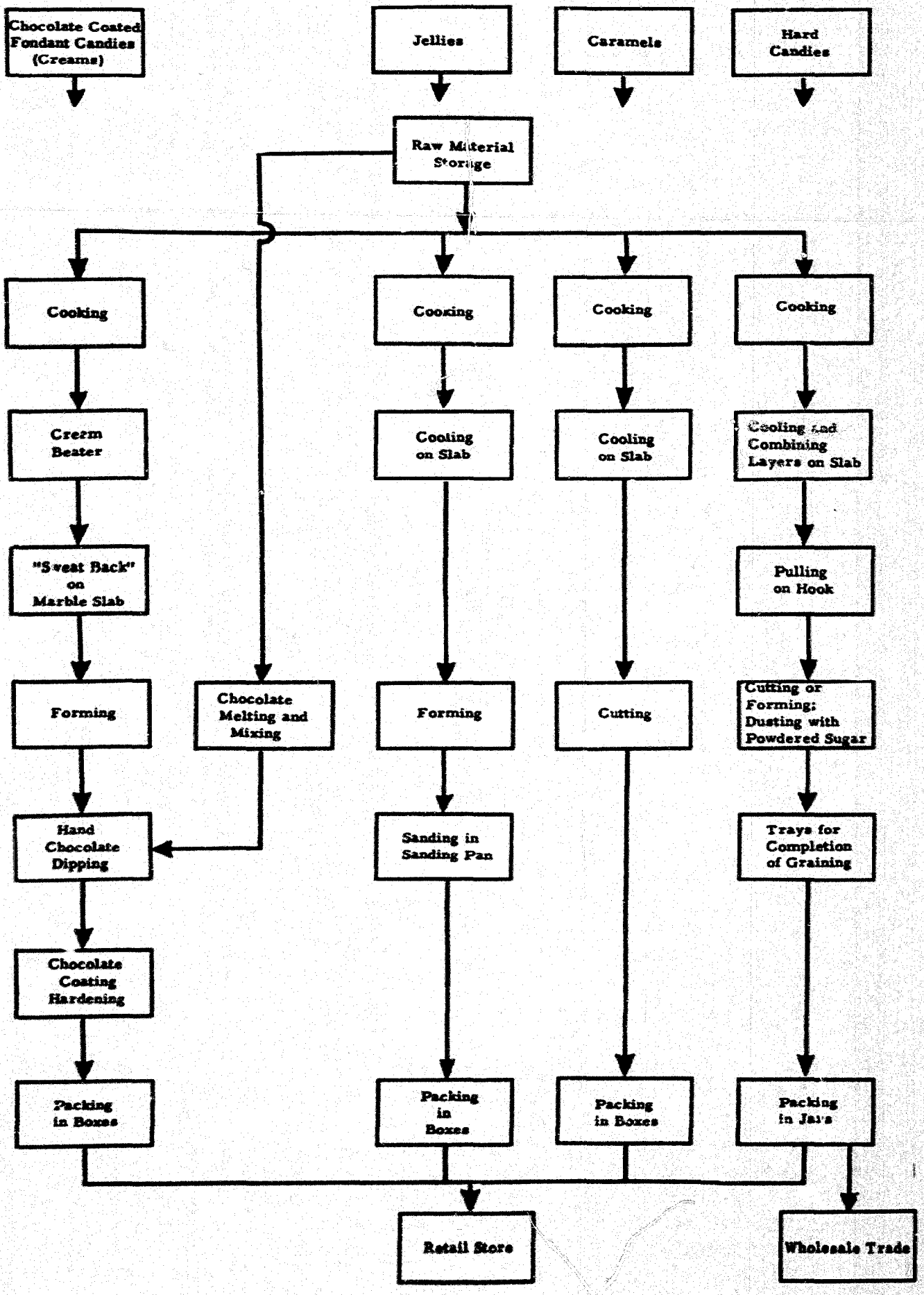
Depending on the amount of corn syrup included in the formula and whether or not vacuum or other kettles are used, the cooking procedure may vary slightly.

The creamy mixture is now required to "sweat back." It will soften by itself when left covered for about 20 minutes, usually on the large marble slab (Figure 3) onto which the mass was poured. This procedure is preferred for the beginning enterprise, since most mixtures suitable for casting into forms require special drying equipment.

FLOW DIAGRAM

CANDY MANUFACTURER-RETAILER

AND LIMITED MANUFACTURER-WHOLESALER



Although the funnel (Figure 4) and rubber matting may be used for forming cream candies and others which are dipped later in sugar coating (Figure 5), the hand-formed creams are considered here. With the use of inexpensive hand tools (Figure 6) and flour as dusting agent, satisfactory shapes can be produced. After forming, the candy must remain untouched sufficiently long to permit formation of a crust prior to the next operation, coating.

Provisions have been made for sugar coating (icing) in the equipment list; however, chocolate coating is referred to in this section. For the beginning period of plant operation, hand coating or hand dipping is suggested, though small stationary inexpensive coating machines are available. The hand operation will permit investing more in equipment for producing a profitable line of inexpensive candy for wholesale distribution while enabling the plant operator to charge slightly more for hand-dipped candy for his retail outlet.

There are several methods of hand dipping chocolate. Only the one producing a better quality finish is mentioned here. Purchased chocolate in block form is melted and mixed in the dipping pot (Figure 7). A small amount of unseeded chocolate is taken from the electrically heated dipping pot and placed on the marble slab (Figure 8). This chocolate is mixed and cooled by hand until seeding strongly and becoming pasty. The center to be coated is placed in this chocolate and covered by hand with it.

Excess chocolate is shaken off as the new coated center is removed and placed on trays (Figure 9) lined with high gloss paper. The trays are left standing for one hour, or they are momentarily put in a refrigerator for the coating to harden. The candy is then stored in boxes and is ready for sale unless it is of the type which requires some days for the center to soften.

Hard Candy

Hard candy making is almost an industry in itself and unfortunately can be discussed here in only general terms. It is an important sales item for the candy manufacturer. Certain varieties of hard candy are ideal for the retail manufacturer who wishes to develop a line of inexpensive candy for wholesale distribution. This step is contemplated for the potential plant operator for whom this report is intended.

Basically, hard candy is a mixture of high cooked water and sugar with the addition of cream of tartar or corn syrup. Suitable flavors are added.

There are two types of hard candy, (1) open fire (with a forced draft furnace), and (2) vacuum cooked. For reasons mentioned earlier, the open fire method is considered here. As mentioned under "Corn Syrup (Glucose)," page 4, vacuum equipment should be purchased only when the enterprise is firmly established.

There are two groups of open fire type hard candies, (1) the straight sugar candy which develops a grain, and (2) the hard candy of a high gloss finish where graining was prevented by the large use of corn syrup or invert sugar.

There are many recipes for making hard candy and each changes the manufacturing process slightly. However, the following procedure is typical for a large group of hard candy types.

A mixture of water, sugar and cream of tartar is cooked to 320°F. on a forced draft furnace (Figure 10) and poured on an oiled marble slab for cooling (Figure 3). To part of the batch, flavor and coloring are added. The colored candy is kept on a warm slab together with another portion taken from the large batch. When the large batch is cool enough to pull, a small amount of glycerin and powdered sugar is added, and the batch is pulled slightly.

It is placed on a warm table (Figure 11), formed into an oblong block, and covered by the uncolored small batch. Over this are placed strips of the colored batch. The entire mass is pulled out to the desired thickness with a pulling hook (Figure 12), It is cut or formed to size, dusted with powdered sugar and remains in the trays until the graining-off is completed. It is then ready for sale.

There are many many recipes and methods for making hard candy.

Whipped Goods

There are certain types of candy which are aerated by whipping with gelatin or albumen.

In this group, various types of marshmallows, both cast and slab cooled, are popular in the United States. Since frappés belong in the same group and are popular outside the United States, some remarks should be made about them in this report. Frappés are used in cream candies, nougats and others. While only the egg frappé is reviewed here, the frappé made with gelatin goes through a similar process and the variation will be indicated by the recipe.

In making frappés, sugar, corn syrup and water are brought to a boil; dextrose and invert sugar, serving as doctor and tenderizer, and starch suspended in water, acting as colloidal agent, are added. When the mixture reaches about 230°F., it is beaten on a Hobart mixer (Figure 14) until its temperature drops to 160°F. To this, egg albumen, which has been soaking in water, is slowly added and the mixture beaten fluffy. Over-beating is dangerous and great care is necessary if the whipped mass is to be stored. The containers must be dry, clean and closed.

Jellies

The jellies referred to here are sometimes known as the pectin jellies or marmalades and are made from water, pectin, sugar, corn syrup (at times), acid, fruit and buffer salts. They should not be confused with jelly gums that are made mainly with corn starch and require special drying equipment and know-how. It is recommended that the beginning plant operator not attempt to produce the jelly gums.

Without complex equipment, jellies may be made in rather large volume and in many forms and flavors. They may be sanded, chocolate coated, nut and coconut decorated, filled with fruit or nut pieces, etc. Reliance on the pectin supplier in arriving at the proper recipe and method of production is suggested, since there are many kinds of pectin. Since these manufacturers give cooking temperatures in degrees above water boiling point, the plant operator must know the altitude at which the plant is located. It must be remembered that altitude affects the water boiling point.

The general cooking procedure is as follows: The pectin is mixed with granulated sugar and added to heated water. When it reaches boiling point the buffer salt, corn syrup and part of the acid are added. Again, the mixture must reach boiling point and the remaining sugar is added. All is now heated to finishing temperature, and after the heat is shut off, the flavor, fruit, remaining acid and color are added and mixed. The whole mass is poured onto the oiled slab. When set it is cut and is usually finished by sanding with sugar in the sanding pan (Figure 15) but may be coated.

Caramels

Caramel, too, is a basic type of candy. It is sold uncoated or coated; with various flavors including chocolate; plain or with nuts. It may be sold as rolls and can be used as coating. The method of production varies for each type.

Proper mixing, good quality ingredients, and knowledge about their cooking reactions are essential if quality caramels are to be produced. Milk is not only important for flavoring the caramel but also helps improve its stand-up quality; that is, it aids in keeping the shape of the candy and prevents flowing when unpacked. Because of the milk, the cooking batch is continuously stirred to avoid scorching.

Sugar in caramels controls their tenderness, and corn syrup controls the graining. In warm climates, corn syrup is used in larger quantities.

Fat, dairy or vegetable butter is added to aid as a lubricant in cutting, wrapping and eating. It also prevents sticking. Lecithin is sometimes used as an emulsifying agent with vegetable butter for binding it to boiling syrup. It also helps the general process and prevents sweating of the finished caramel.

The sugar, moistened with a little water, the corn syrup and butter are cooked slowly under a low fire with the fire mixer (Figure 16) until well mixed; the heat is then raised to about 240°F. Half the cream or milk is added (anti-curdling stabilizer may have been previously mixed with the milk products), and cooking continues at a slightly raised temperature. Then the second half of the milk products is added, the whole batch is stirred constantly and cooked at 248°. When finished, the mass is poured for cooling on the oiled slab. Nuts, chocolate, and other flavors may be used. Layers of different mixes are often assembled into a fine caramel.

Low-Cook Syrup Candy

In almost every candy there is an ingredient upon which the cooking process depends to form the candy's body. However, there is a special group of candy, the body of which is stiffened through the use of a filling agent. The filling agent prevents the syrup from separating. Coconut and ground popcorn are usually used, among others, since they readily absorb moisture. There are no particular rules as to how such candy is made, except that a filler is needed and that low-cooked syrup is used. Depending on local market, this may be a profitable sideline. Ungrained coconut candy, molasses coconut squares, or fruit flavored types are popular.

Cordials

When a hot supersaturated solution of sugar in water has cooled off, the excess sugar will have moved to the side, forming a crust and leaving a liquid center remaining. Basically, all solutions having this characteristic belong among the cordials.

Cordial fruits are properly prepared fruit (mostly cherries) dipped in just such a mixture (which has usually been creamed) and then chocolate coated. The fruit's own moisture will also help liquify the cream. Invert sugar in the cream will speed the liquifying process too. After two weeks of storage, the center will be liquid.

* * * *

The foregoing covers the principal candies which are the most practical for a beginning operator, taking into consideration equipment requirements. Almost all other candies are a combination of several of the above-described basic processes and candies. For instance, nougats are a combination of hard candy and whipped egg frappé. Truffle type candy is a sweet cream mixed with chocolate, etc.

It is suggested that at the beginning only tried formulas be used and also that production be limited to those candies which remain fresh for comparatively long periods in the local climate.

PLANT REQUIREMENTS - PHYSICAL

A general review of a candy plant would be incomplete without special emphasis on water, sanitation and air-conditioning factors. Not only the making of quality candy but the prevention of losses during manufacturing and throughout the period before the candy is eaten depend largely on proper attention to these factors.

Water

Cool well water, low on alkaline and otherwise chemically clean is best for the candy plant. Its coolness reduces air-conditioning cost, while the alkaline content affects the action of such items as cream of tartar, especially in hard candy. Water with traces of copper or iron can shorten the shelf life of candy by spoiling flavors, marring colors, or increasing the danger of rancidity. Hence, a chemical analysis of the available water should be made, and, if necessary, proper water softening, filtering or de-alkalizing equipment should be ordered. This will also have a beneficial effect on the hot water boiler and air-conditioning equipment.

Sanitation

A clean and sanitary plant has many beneficial results. It is management's task to issue directives to keep the plant spotless and to see that these are carried out. Principal benefits to management are improved morale among employees, increased productivity, higher quality, less loss due to spoilage, and a better reputation among consumers.

The plant must be planned with proper sewers, traps which are easily cleaned out, and sanitary tiling to the full extent. The floor must slope properly toward the sewer so that a hose may be used for frequent washing down. The floor must be kept free of holes and in first-class condition.

Daily cleaning routines should cover at least the following: kettles, hand tools, slabs, mixer, garbage cans, floors, dressing room and toilets. Brushes and the proper detergent from among the many good detergents now available should be used, together with hot water. Window washing, cleaning of window screens, wiping down of piping and machines, and washing of walls must be done frequently. To sanitize completely, hypochlorite may be used.

Germicidal lamps are used more and more as bacteria killer and have helped reduce mold growth, particularly inside the retail store.

Workers should also wear white uniforms and white hats.

Despite extreme cleanliness, insects may endanger the operation of the candy plant. Extreme care in sanitation, fumigation, and selection of reputable suppliers are the best insect controls. The insects may be brought into the plant through the delivery of raw materials such as nuts, and they may thrive in cracks in the wall or floor. A good residual spray may be sufficient. If not, a professional fumigator should be called for advice.

Air-Conditioning

Without air-conditioning, candies may begin to sweat and become sticky; chocolate will bloom or become rancid. Hence, to prevent losses and extend shelf life of candy, air-conditioning is essential. How large the system should be will depend on the local climate. It is considered best and more economical to plan a system larger than for the immediate needs.

For this projected plant, it may be more economical to purchase several self-contained units, which would be sufficient in supplying the clean tempered air required for the different candy plant activities without involving expensive ducts and control instruments.

In a hot climate, water spray on the roof might be economical and practical. Well water will be most economical for the air-conditioning system.

Generally, the system will be divided into areas:

Raw material storage
Cooking
Tempering and general work room
Dipping and packing room
Finished goods storage
Retail store

Both temperature and humidity vary for each area. The formulas and candies to be produced will also be a deciding factor in designing the system.

In the cooking area, depending on the climate, the air may be sufficiently tempered with ordinary ventilation. As a general guide, these figures might be considered when designing the plant's air-conditioning needs:

	Temperature	Relative Humidity
Raw material store	40°F.	60%
Tempering and general work room	75	50
Dipping and packing room	65	55
Finished goods store*	65	50
Storage of nuts	35	75
Retail store	75	50

* Exclusive of nuts and chocolate.

Note: If molded candy is made in quantities, a drying chamber will be needed.

PLANT REQUIREMENTS - QUALITY AND COSTS

Quality in the Candy Factory

There is probably no branch in the food industry where loss of customers due to poor quality products can be as serious as in the candy industry. Hence, not enough attention can be given to turning out a consistently good quality product.

The following guiding principles should affect control over quality:

1. Recipes must be suitable for the climate and seasonal climatic changes.

2. The plant must be spotlessly clean and sanitary.

3. Use air-conditioning equipment.

4. Use an outside laboratory to check periodically on the quality of all ingredients used.

5. Keep a written record of systematic checking of quality of ingredients and finished product.

Watching Costs in a Small Candy Enterprise

Commerce and industry have become more and more complex through the years. Even among small manufacturers it is now recognized that having a proper accounting system is as important to profitable plant operation as are proper tools and machines.

Lack of proper accounting means lack of proper records and lack of information. To make sound decisions based on facts, rather than guesses or memory, the factory manager must have proper records and accurate information.

It is therefore assumed that, from the outset, the projected candy enterprise will have proper and accepted financial controls, that is, a good bookkeeping system maintained by a qualified bookkeeper.

In addition, the candy manufacturer must know what his costs are. Following is a simple but effective system for controlling costs which can be easily kept up to date at all times.

In a loose-leaf notebook maintain a separate page for each formula filed in alphabetical order. Enter the ingredients and their weights on each formula page, including last price paid per unit for each raw material (in pencil). Keep a similar file with one page for each ingredient used in the plant. Enter the arrival date, quantity and price paid for shipments of each ingredient on its proper page.

When a batch is finished, it must be weighed and the yield compared to what is shown on the formula sheets, since its weight will no longer be the same as the original total ingredient weight. This yield figure, together with last prices paid for raw materials, permits periodic refiguring of material costs per pound. Since raw material prices are fluctuating considerably the world over, cost information is essential. It may be necessary to pass increases on to the consumer. Likewise, decreases, if not reflected in the selling price, may prevent getting a larger share of the local consumer market.

The individual ingredient sheet mentioned above also permits easy continuous stock control.

COST RATIOS IN THE CANDY INDUSTRY

In countries where the candy industry is large and very competitive and especially when aiming for the mass market, an enterprise requires large amounts of capital. To reduce raw material costs the candy maker must purchase in large quantities,and to reduce direct labor costs he must mechanize his operations.

However, if he produces only a candy specialty, this situation may change. A small candy enterprise, ably managed and producing quality candy, can operate profitably. Its customers are ready to pay more for hand-made homemade candy, and overhead and financial commitments f[illegible] the

manufacturer are greatly reduced.

For instance, in the United States in 1955, typical operating profits (profits before non-operating income and deductions and taxes on income) may be compared by types of candy producers as follows:

Typical Operating Profit

Year 1955

Manufacturer Wholesalers	
General line houses	1.42%
Bar goods houses	5.58
Package goods houses:	
To retail at $1.00 or more per pound	4.12
To retail at less than $1.00 per pound	3.91
Bulk goods houses	1.41
5¢ and 10¢ specialty houses	4.32
Penny goods houses	3.45
Manufacturer-Retailers	3.33

Note: These figures are based on the American candy industry and cover enterprises larger than the one assumed in this report. However, the comparison between the different types of candy factories should be of interest.

The disadvantage of expansive raw material buying for the small enterprise may be offset by, among other things, the possibility that the potential candy plant operator is located in a country where some of the candy's main ingredients are locally grown.

On the other hand, the potential operator may have to import raw material with hard-to-get foreign currency. His labor costs and taxation differ from those in the United States, while his distribution system and selling expenses are dictated by local conditions.

Even though situations differ, the cost ratios below will be most meaningful to the potential operator, since they will paint an average, yet total picture, of cost relationships for manufacturer-retailers.

OPERATING RATIOS IN 1955

TYPICAL FOR U.S. MANUFACTURER-RETAILERS

Net sales	100.00%
Costs of Products Sold	
Raw materials	35.18%
Packaging materials	9.87
Total materials	43.20%
Production labor	11.16
All other manufacturing labor	4.07
Total labor	15.99 %
Indirect manufacturing materials and supplies	.46
Fuel, power and light	.66
Depreciation on factory machinery and equipment	.92
Occupancy costs	1.06
Taxes other than real estate and income taxes	.70
All other manufacturing expenses	2.37
Cost of production sold	62.15 %
Gross profit	37.85 %
Commercial Expenses	
Shipping and finished product storage expenses (where reported as a separate classification of expense)	2.88 %
Retail outlet distribution expenses (as percent of retail sales only)	34.25 %
Selling expenses:	
Salesmen's salaries, expenses and commissions	4.47
Advertising and promotion	2.07
All other selling expenses	2.19
Total selling expenses	9.50 %

Commercial Expenses (Cont'd)

Administrative expenses:	
Executive and clerical salaries	2.83%
All other administrative expenses	1.63
Total administrative expenses	4.52 %
Total commercial expenses	34.25 %

Operating Profit

Profit before nonoperating income and deductions, and taxes on income	3.33 %

Note: These figures are typical ratios and, since they do not represent the same company throughout the column, they will not add or subtract to the typical totals and subtotals shown.

FINANCIAL FORECAST

GENERAL CONSIDERATIONS AND ASSUMPTIONS

1. Costs are based on latest published average figures available for the industry in the United States. For material, 1955 figures were used; for labor, 1952 figures. Certain allowances were made for known increases.

2. For equipment, the latest available price estimates were used. Averages were used for other costs. In applying these figures to a particular projected candy plant, the following main points should be considered:

   (a) Locally available raw material (especially sugar, corn syrup, and chocolate) may considerably change the price estimates for raw material unit cost.

   (b) The ratio of coated fine candies produced, against inexpensive hard candy produced, will also change raw material costs considerably. It will, in addition, affect labor cost, since more or less hand-dipping will be required. It will also affect the productive capacity of the equipment and the productivity of the plant. While a minimum of 400 pounds production per day is assumed, the above-mentioned ratio will greatly influence these production cost and utilization figures. The equipment is capable of producing considerably more than the assumed figure.

3. It is assumed that the manager is also the owner.

4. Depending on geographical location and currency regulations, the inventory figure may require adjustment.

5. Accounts receivable estimate will be affected by ratio of goods sold through retail store to goods wholesaled to others.

ESTIMATED BUILDING REQUIREMENTS

A building 50 ft. X 75 ft. should be sufficient for a retail store, manufacturing area and storage of finished goods and raw material. The area breakdown would be as follows:

Retail store	625 sq. ft.
Manufacturing	2,200 sq. ft.
Storage	925 sq. ft.
Total area	3,750 sq. ft.

The building would be of light steel framing construction with a non-combustible roof deck. It would be built of concrete cement blocks, painted inside with a washable paint (interior sanitary tiling preferred) and it would cost approximately $37,000. Air-conditioning will cost approximately $3,800. (This cost could be reduced by ventilating only the cooking area.)

ESTIMATED LABOR REQUIREMENTS

Direct Labor	Rate Per Hour
(1) Candy maker, Class A, male	$ 2.10
(1) Candy maker, helper (he would also make minor repairs, help in heavy lifting, cleaning, etc.)	1.47
(3) Candy dipper and packer, female (varies with season); may also help in retail store	1.47

Indirect Labor	Annual Salary
(1/2) Manager (purchasing, outside sales, administration, factory supervision, etc.)	$3,500

(See section on sales and administrative expense for one-half the cost of manager's salary.)

ESTIMATED EQUIPMENT REQUIREMENTS

(2)	Gas furnace, Economy #20 (for propane)	$ 200
(1)	Gas furnace, forced draft with blower (for hard candy cooking)	293
(2)	Kettle, 22 X 12 inches	100
(1)	Kettle, 24 inches	49
(2)	Chocolate melter (optional at beginning)	1,300
(2)	Marble slab on rolling frame, 3 ft. X 6 ft. X 2 in.	200
(1 set)	Slab bars	12
(2 sets)	Slab bars, 3/4-in. sq. (which, when set up, fix the area onto which batch is poured)	25
(2)	Adjustable roller cutter (4-in. knives)	115
(1)	Cream beater-mixer, 3-ft.	1,214
(1)	Fire mixer, complete with furnace, kettle and drive (for caramel mixing)	770
(1)	Hobart mixer (for nougats and egg frappes)	1,565
(1)	Uniform cutter (for hand rolling creams)	15
(1)	Chocolate dipping table, 2-girl, 10 quarts, including 16 X 18-in. dipping marbles, electrically heated	235
(1)	Interlocking dipping tray (for stacking), wooden, 12 X 18 in. (as sample only; it can be easily reproduced)	--
(1)	Bonbon dipping table (for sugar coating creams, etc.)	192
(1)	Funnel dropper, 3/8-in. opening (for cream patties and cast creams)	6
(2)	Bonbon dipping fork	3
(1)	Combination heating-cooling table, 3 X 6 ft. (for hard candy making)	353
(2)	Pulling hooks	6
(1)	Fruit drop frame with 8 sets of rollers (for candy forming)	900
(1)	Batch warmer, 42-in. (prior to forming of candy)	35
(1)	Electric sanding pan, 18-in., copper (for sanding or chocolate coating of nuts)	325
(1)	Nut roaster (to set on oven)	60
	Rubber molds of various designs	55
	Rubber matting (for bonbons), 3 X 6 ft.	12
	Various tools such as thermometers, paddles, scraper, pallet knives, sieves, etc.	150
(2)	Weighing scale, large and small	120
(1)	Electric heated hot water tank, 50-gal.	250
(1)	Refrigerator	250
	Water softener	600
	Alkaline remover (needed only when water has high alkaline content)	(600)
(1)	Small delivery truck	2,800
	Assorted spare parts, small tools	250
	Total estimated cost of equipment	$12,460

ESTIMATED INVENTORY REQUIREMENTS

Raw Material and Ingredients (1 month)

8,400 lbs. X average price of $0.35 per pound, based on 400 lbs. minimum daily production in one eight-hour shift, five days per week, 50 weeks per year (process losses are not considered)	$2,940

Other Supplies

Packing material, including storage container replacements	140
Total inyentory	$3,080

ESTIMATED OVERHEAD

Depreciation Schedule

	Cost	Years Life	Annual Depreciation
Building	$37,000	20	$1,850
Store fixtures	--	-	--
Air conditioning unit	3,800	10	380
Production equipment	12,460	10	1,246
Total	$53,260		$3,476

Estimated Monthly Overhead Expenses (exclusive of selling and other commercial expenses)

Depreciation	$ 289
Indirect labor (supervision)	291
Water, fuel, power	50
Repairs and other expenses	50
Total	$ 680

ESTIMATED UNIT COST OF MANUFACTURING

Direct Labor	Annual Wages
1 candy maker, Class A	$4,200
1 candy maker helper	2,940
3 candy dippers	8,820
Total	$15,960
20% overhead for vacation, sick leave, training, government, insurance, etc.	3,192
Total per year	$19,152

$$\frac{\$19,152}{12 \text{ months}} = \frac{1,596}{8,400 \text{ lbs. monthly production}} = \$0.19 \text{ per pound}$$

Materials

$$\frac{\$3,080 \text{ monthly inventory}}{8,400 \text{ lbs. monthly production}} = \$0.37 \text{ per pound}$$

Overhead

$$\frac{\$680 \text{ monthly}}{8,400 \text{ lbs. monthly production}} = \$0.08 \text{ per pound}$$

Estimated total cost of manufacturing = $0.64 per pound

ESTIMATED CAPITAL REQUIREMENTS

Estimated Working Capital Requirements

Inventory	$ 3,080	
Payroll	1,596	
Overhead	680	
Accounts receivable	3,400	
Total		$ 8,756

Fixed Assets

Land	--	
Building	$ 37,000	
Air-conditioning unit	3,800	
Equipment	12,460	
Total		53,260
Total capital requirements		$62,016

ESTIMATED SALES REVENUE

Monthly sale of 8,400 lbs. of candy, sold through the retail store, and the hard candy wholesaled to others, at an average sales price of $0.85 per lb. = sales revenue of $7,140 per month.

PROFIT AND LOSS PROJECTION (ONE MONTH)

Income from sales		$7,140
Less cost of manufacture (8,400 lbs. × $0.64)		5,376
Gross profit on sales		1,764
Less:		
Estimated sales and administrative expenses:		
Bookkeeper	$ 80	
Commissions	160	
Sales girl	220	
1/2 Sales manager	292	
Advertising	50	
Gas and oil for truck	100	
Total		902
Net profit (before interest, taxes, insurance, etc.)		$ 862

APPENDIX 1

AVERAGE COST PER POUND OF SELECTED INGREDIENTS USED BY THE UNITED STATES CONFECTION INDUSTRY

	1953	1954	1955
Sugar and sweeteners:			
Cane and beet sugar	$ .088	$.086	$ .086
Corn sugar	--	.076	.077
Corn syrup	--	.061	.061
Other sweeteners (molasses, maple sugar, honey, etc.)	--	.063	.057
Corn starch	--	.075	.077
Cocoa beans	.325	--	--
Cocoa powder	.276	.367	.420
Cocoa butter	.703	1.022	.700
Chocolate liquor	.448	.665	.515
Chocolate coatings - total	.362	.465	.416
Milk	--	.451	.400
Dark	--	.502	.448
Light sweet	--	.447	.448
Cocoa powder composition coating	--	.259	.239
Fluid milk	--	.032	.033
Condensed and evaporated milk:			
Unsweetened	.124	.100	.069
Sweetened	.116	.100	.117
Dried milk, non-fat and full-fat	.254	.261	.297
Cream	.279	.277	.314
Creamery butter	.655	.567	.563
Other milk products	.245	.218	.223
Eggs and egg products:			
Fresh or frozen	--	.195	.181
Other	--	1.616	1.552
Fats and oils (vegetable oils, hydrogenated shortening)	.210	.222	.192
Essential oils and flavorings (peppermint, vanilla, licorice, etc.)	--	1.157	1.094
Fruits, jam, and fruit products	--	.264	.319
Peanut kernels	.200	.204	.232
Coconut meal, fresh or prepared	--	.197	.171
Almond kernels	.626	.607	.666
Nut meats (pecans, etc.)	--	.645	.768
Other ingredient materials	--	.178	.193
Total		$ .158	
Finished goods marketed		$ .382	

Source: United States Department of Commerce

APPENDIX 2

GLOSSARY OF TECHNICAL TERMS

USED IN THE CANDY INDUSTRY

Acidulant - Acids which are added to candy to bring out the flavor of fruit or to give it a sour taste.

Aerate - Combining egg whites or soy albumen with air or gas by beating. Also increases volume.

Agitator - Paddles which revolve in cooking and melting kettle. When equipped with scrapers, they prevent candy from sticking to the kettle during cooling process.

Batch Warmer - A metal topped heating device used to keep hard candy plastic while waiting or being worked.

Bob - A syrup added to fondant when making cream candies.

Bonbon - Candies coated with fondant. May also be glazed solid creams.

Buffer Salt - A chemical added to prevent change in acidity in the mass, though acid may have been added (like slowing down jelly setting so that work can still be done on it, even though acid has been added to the batch).

Circular Knives - Circular knife blades mounted on rod with spacers; used for cutting slab candy. Also called roller cutters or hand cutters.

Colloid - An ingredient that will bind other ingredients together, such as gum.

Doctors - Ingredients like cream of tartar, invert sugar, etc. which govern and retard recrystallization of the sugar in the candy batch.

Funnel - A metal funnel with handle and opening at the bottom; used to deposit candy mass to mats or into rubber molds.

Grain - Large sugar crystals which create a rough texture.

Grain-off - Process of recrystallization of sugar in the batch of candy.

Hydrogenate - Adding hydrogen gas to oils and fats to increase their melting points and reduce rancidity danger.

Hydrolysis - Decomposition or breaking up of a substance by a chemical process, adding water - like fat rancidity resulting from breaking down of fats. Also, incomplete hydrolysis, changing cornstarch to syrup.

Iced Candy - Candy coated with a mixture of sugar, egg or gelatin which has been whipped.

Inversion - The splitting and breaking down of sucrose (cane and beet sugar) into dextrose and levulose through heating sugar solution containing acid (a form of hydrolysis). Temperature and acid control the extent of inversion.

Revolving or Sanding Pan - For hard panned confection coating, a burner may be placed against a revolving pan. Soft panning, such as for jellies, etc., requires no heat.

Sanding - An outer coat of sugar required by some types of candy, pectin jellies for instance.

Setup - Condition of fondant when it is firm, that is, when sugar crystals have fully formed.

Spin or Spin-Out - Process of forming hard candy mix, when it is cooled until plastic, into oblong shape on tables, and pulling with hooks by hand until desired thickness is obtained.

Sweat Back - When fondant batches soften up again, their moisture and sugar contents are stabilized. Before fondant is added to a batch, this sweating back must have occurred.

Sweating - Uncoated candy exposed to relative humidity of over 50% absorbs moisture and becomes sticky. Some candy, like jelly, will sweat, that is, release its own moisture if improperly cooked.

APPENDIX 3

BIBLIOGRAPHY AND SOURCE OF INFORMATION

National Confectioners' Association
of the United States, Inc.
221 North LaSalle Street
Chicago 1, Illinois

United States Department of Commerce
Bureau of Census
Washington, D.C.

United States Department of Labor
Bureau of Labor Statistics
Washington, D.C.

United States Department of Agriculture
Washington, D.C.

Southern Regional Research Laboratory
2100 Robert E. Lee Boulevard
New Orleans, Louisiana

Western Confectioner Journal
251 Kearney Street
San Francisco 8, California

Confectioner Journal
625 West Milwaukee Street
Milwaukee, Wisconsin

The Manufacturing Confectioner Journal
418 North Austin Boulevard
Oak Park, Illinois

Candy Industry and Confectioners' Journal
18 East 49th Street
New York 17, New York

APPENDIX 4

CONFECTIONERY MANUFACTURING CONSULTANTS

Carle and Montanari
New York, New York

Harry L. Friend Co.
Old Colony Avenue
Boston, Massachusetts

Geveke & Co., Inc.
19-25 Broadway
New York 4, New York

J. W. Greer Co.
Wilmington, Massachusetts

Hamilton Copper and Brass Works
825 State Avenue
Cincinnati 4, Ohio

Hobart Manufacturing Co.
Troy, Ohio

National Equipment Corp.
153 Crosby Street
New York 12, New York

Racine Confectioners' Machinery Co.
15-17 Park Row
New York, New York

Savage Bros. Co.
2638 West Gladys Avenue
Chicago, Illinois

C. Tennant Sons & Co.
100 Park Avenue
New York, New York

Union Confectionery Machinery Co., Inc.
Lafayette & Houston Streets
New York 12, New York

APPENDIX 5

MACHINERY AND EQUIPMENT

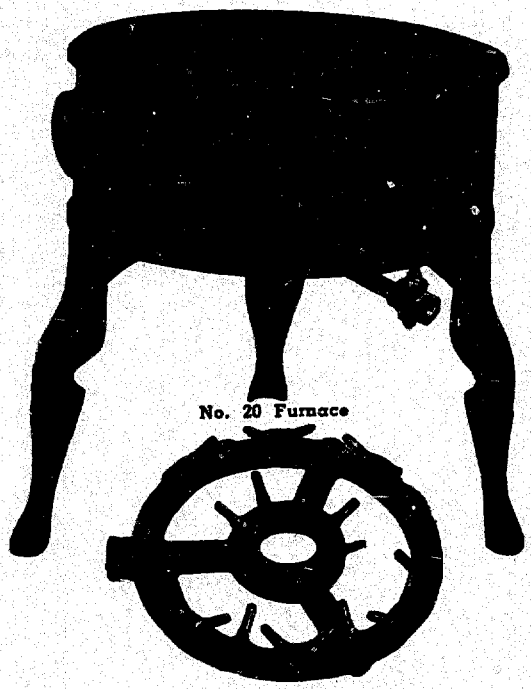


Figure 1 - Gas Furnace

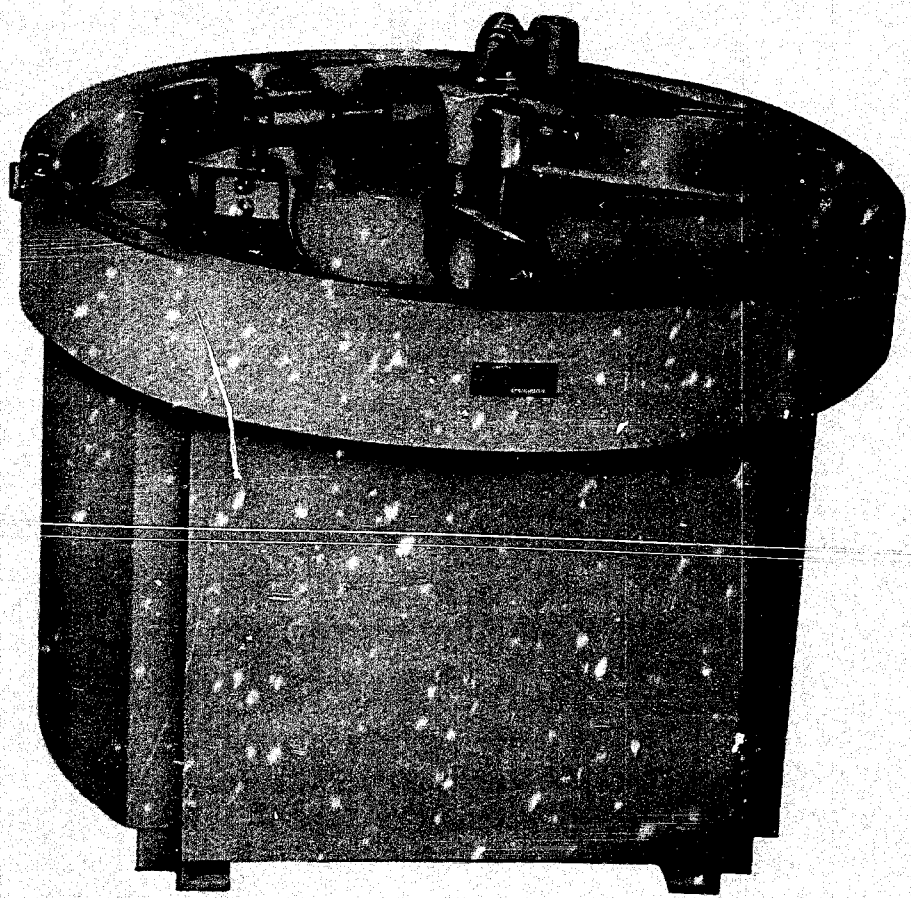


Figure 2 - Cream Beater

Courtesy Savage Bros. Co.
Chicago, Illinois

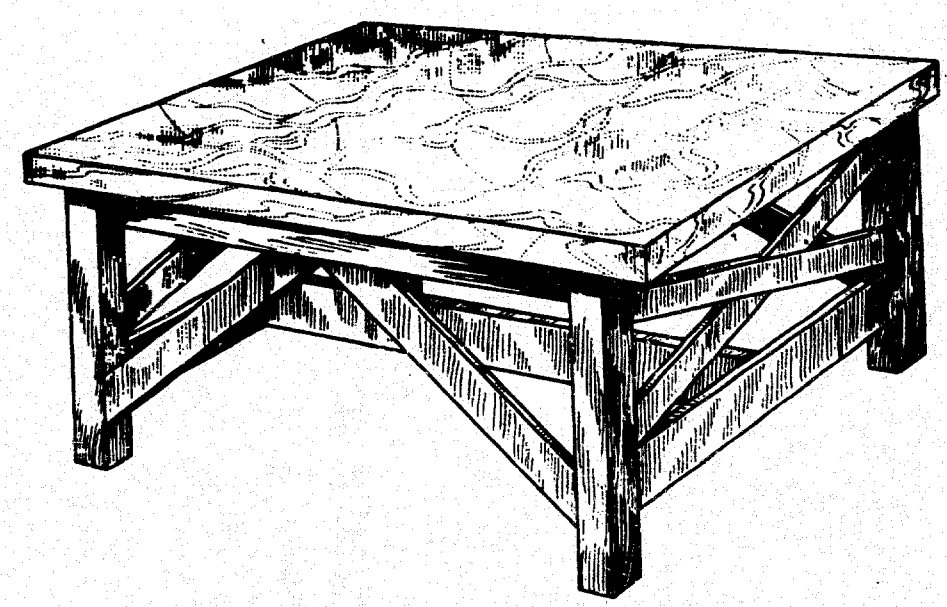


Figure 3 - Hard Marble Candy Slabs

Figure 4 - Funnel Dropper

Figure 6 - Adjustable Steel Roller Cutter

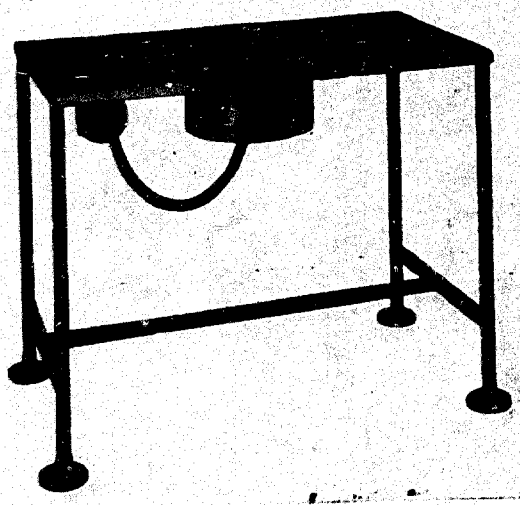


Figure 5 - Bonbon Dipping Table. Supplied with 110 volt copper dipping pot equipped with three heat switch. Capacity 10 lbs. cream.

Courtesy Savage Bros. Co.
Chicago, Illinois

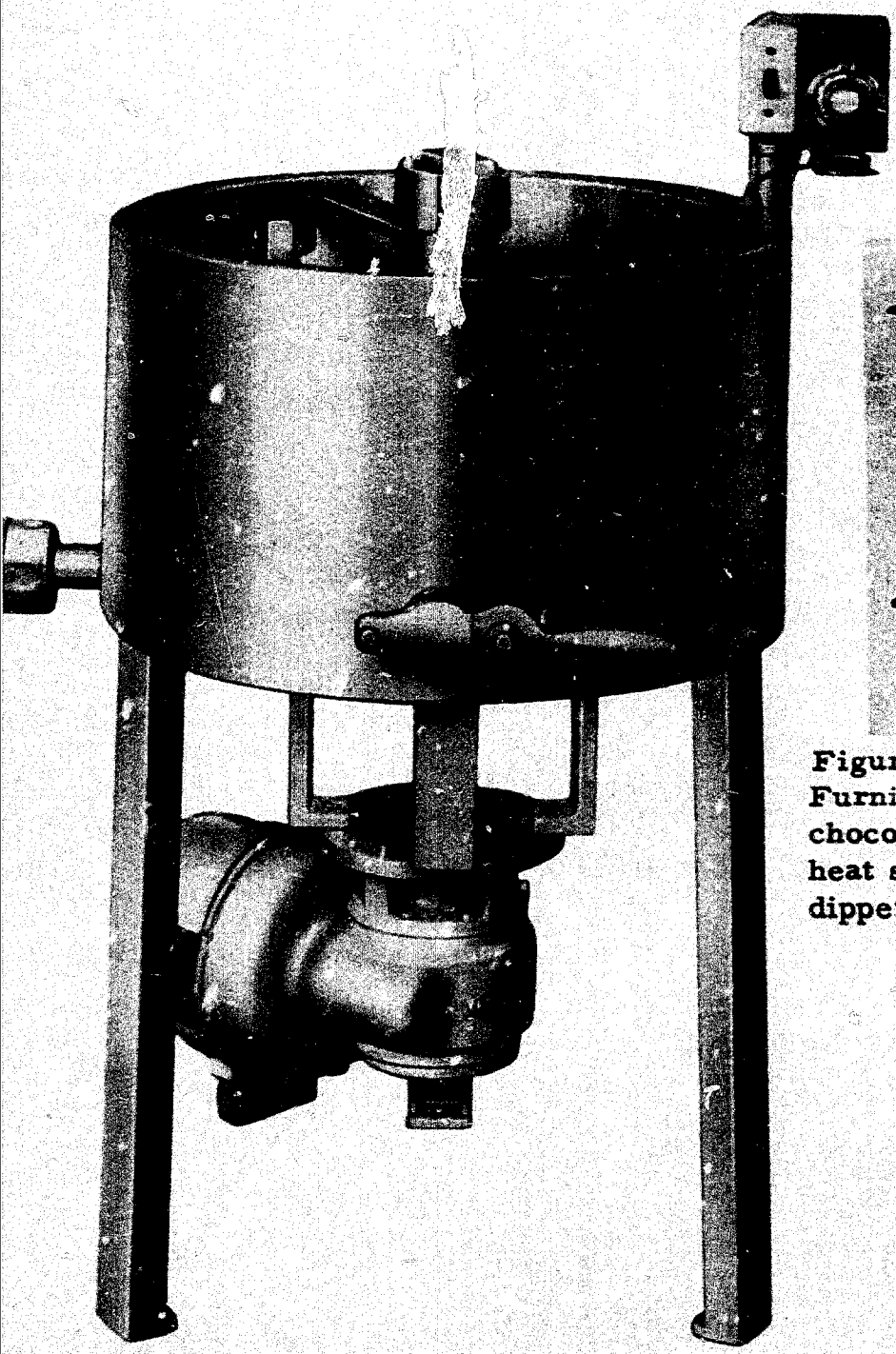


Figure 7 - Chocolate Melter and Mixer

Figure 8 - Chocolate Dipping Table. Furnished with 10-qt. 110-volt electric chocolate warmer equipped with three-heat switch and two marbles for two dippers.

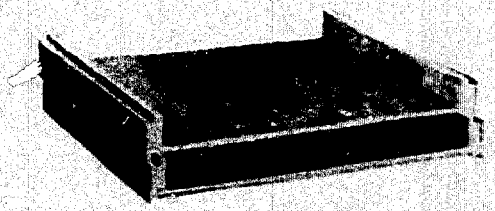


Figure 9 - Interlocking Dipping Trays

Courtesy Savage Bros. Co.
Chicago, Illinois

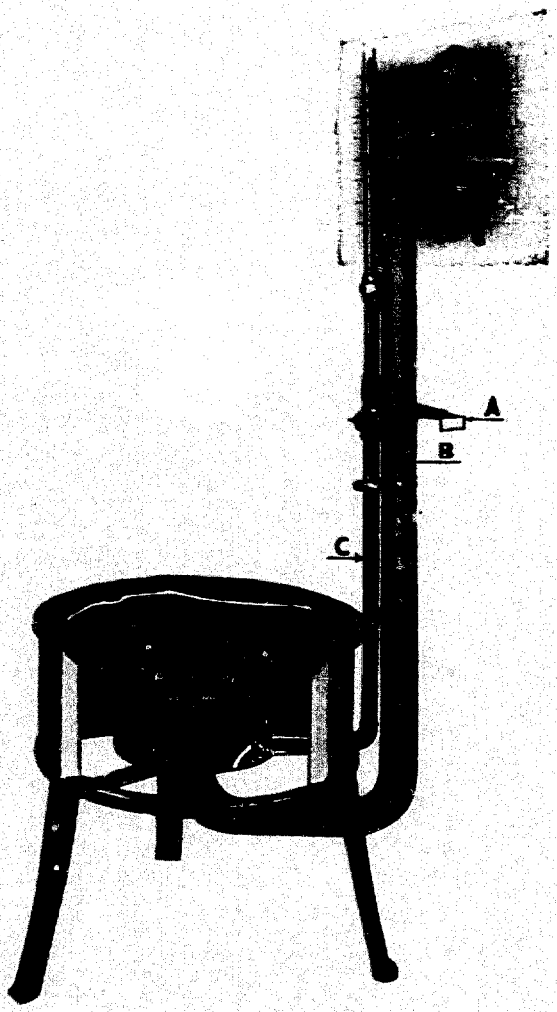


Figure 10 - Forced Draft Gas Furnace

Figure 12 - Candy Pulling Hook

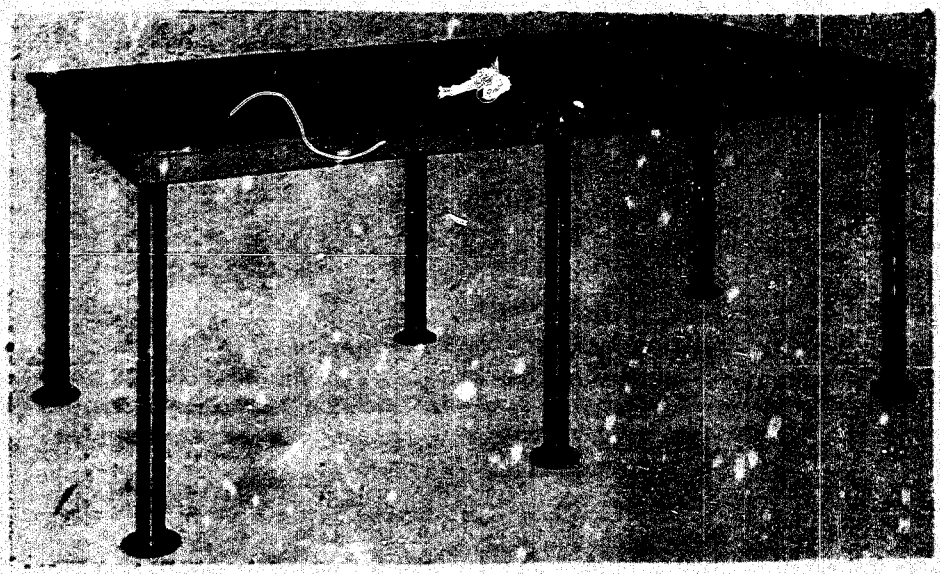


Figure 11 - Cooling or Heating Slab

Courtesy Savage Bros. Co.
Chicago, Illinois

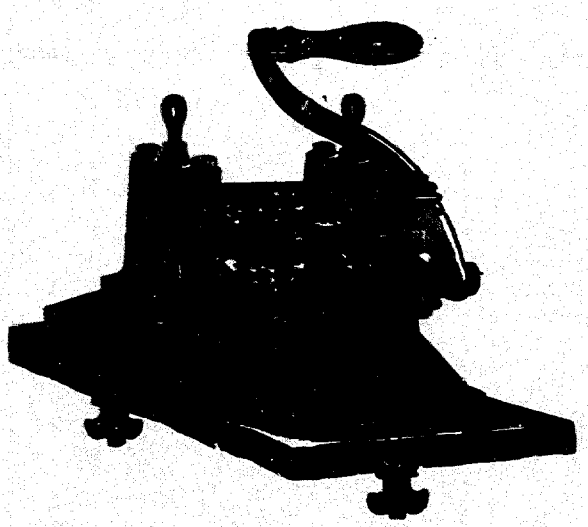
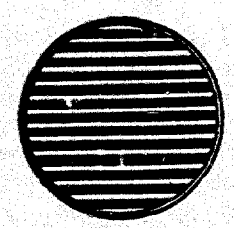
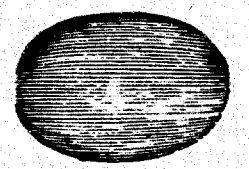


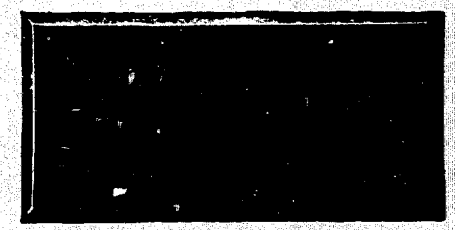
Figure 13 - Fruit Drop Frame and Patterns for Fruit Drop Rollers (Each cut is full size.)



No. 168. Wafer.
163 to lb.

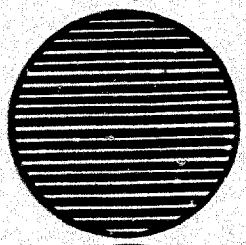


No. 92. Nougat Wafer.
400 to lb.



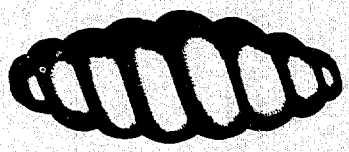
No. 245. Chocolate Chip.
Any thickness to order. 100 to lb.

No. 136. Triangle.
350 to lb.

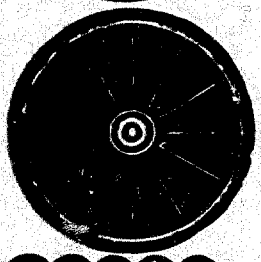


No. 162. Wafer.
118 to lb.

No. 47½. Cough Tablet.
160 to lb.

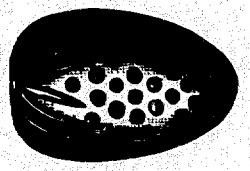


No. 119. Twist Lump.
80 to lb.

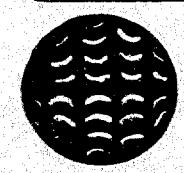


No. 188. Wheel.
135 to lb.

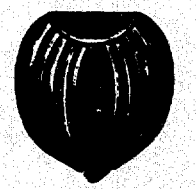
No. 172. Cushion Drop.
117 to lb.



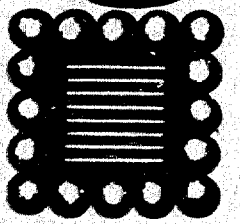
No. 161. Almond.
84 to lb.



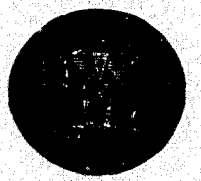
No. 177. Drop.
340 to lb.



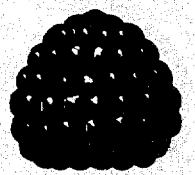
No. 156. Hazel Nut.
125 to lb.



No. 145. Fancy Square.
121 to lb.



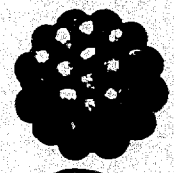
No. 205. Cough Drop.
128 to lb.



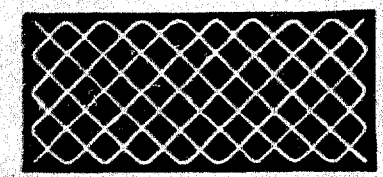
No. 208. Raspberry.
86 to lb.

No. 96. Tablet.
170 to lb.

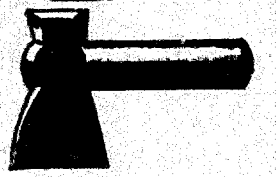
No. 204. Nugget.
170 to lb.



No. 171. Raspberry.
114 to lb.

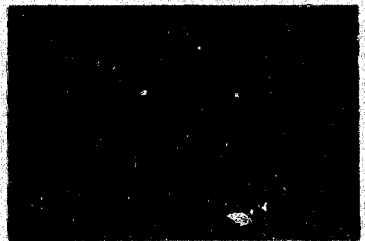


No. 123. Wafer.
135 to lb.

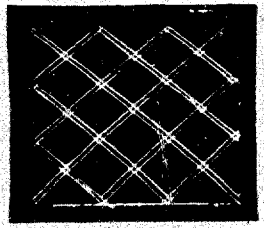


No. 240. Washington Hatchet.
266 to lb.

No. 21. Raspberry.
200 to lb.



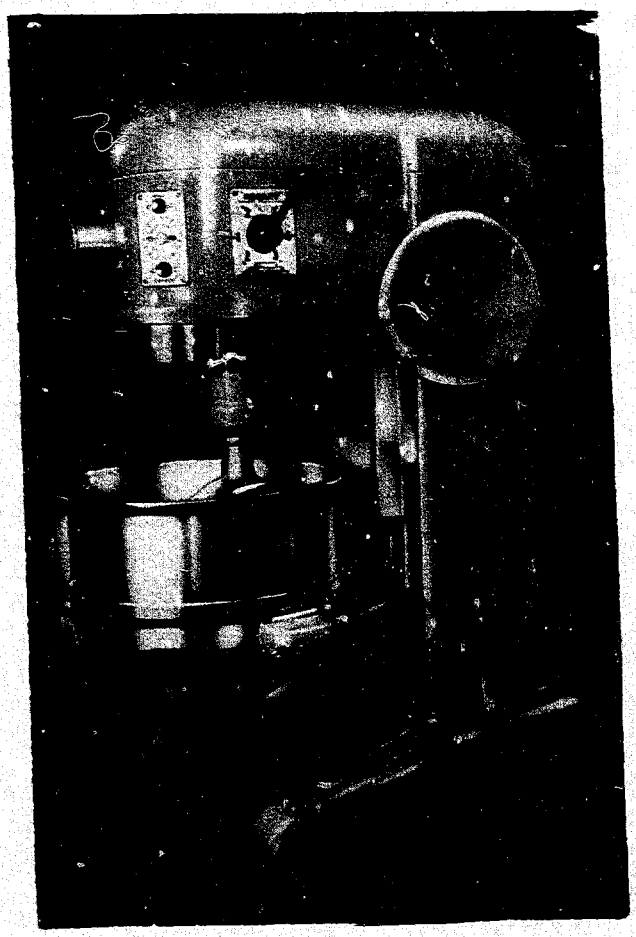
No. 231. Chocolate Chip.



No. 242.
115 to lb.

No. 142. Peach Stone.
200 to lb.

Courtesy Savage Bros. Co.
Chicago, Illinois



Courtesy Hobart Manufacturing Co.
Troy, Ohio

Figure 14 - Mixer

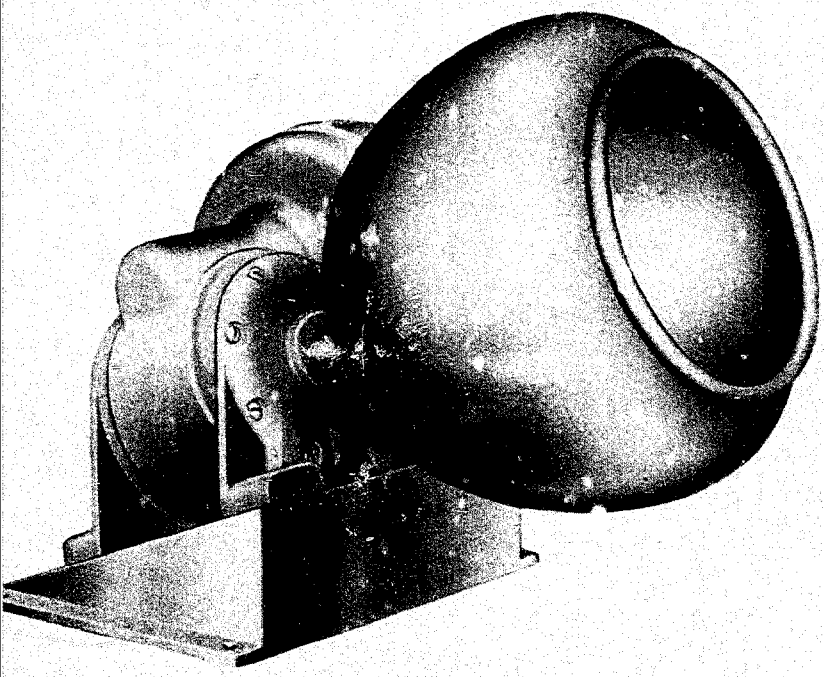


Figure 15 - Copper Coating Pan, 17 r.p.m.

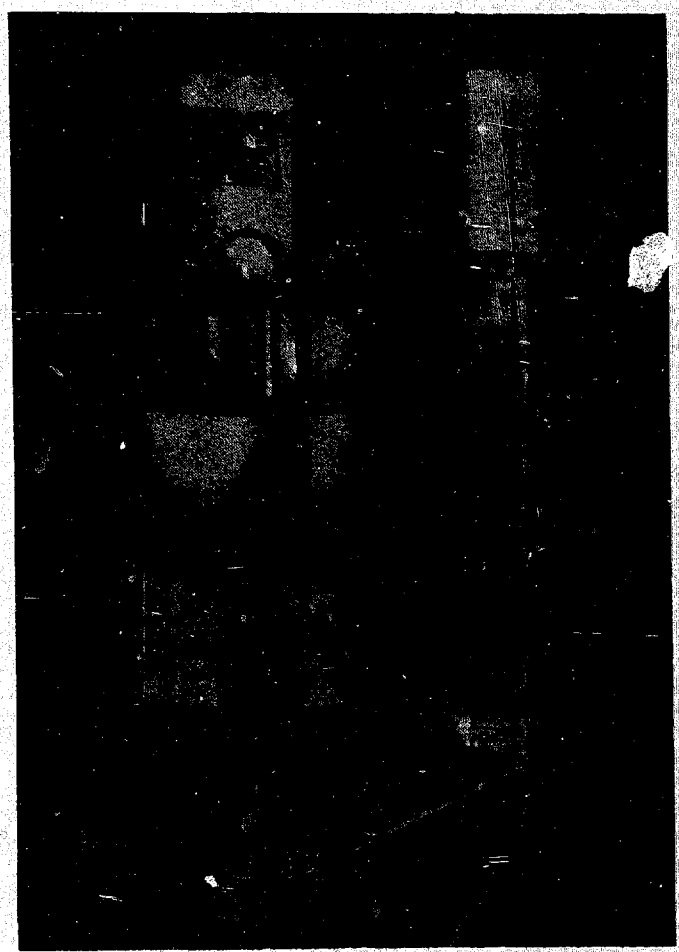


Figure 16 - Portable Fire Mixer

Courtesy Savage Bros. Co.
Chicago, Illinois