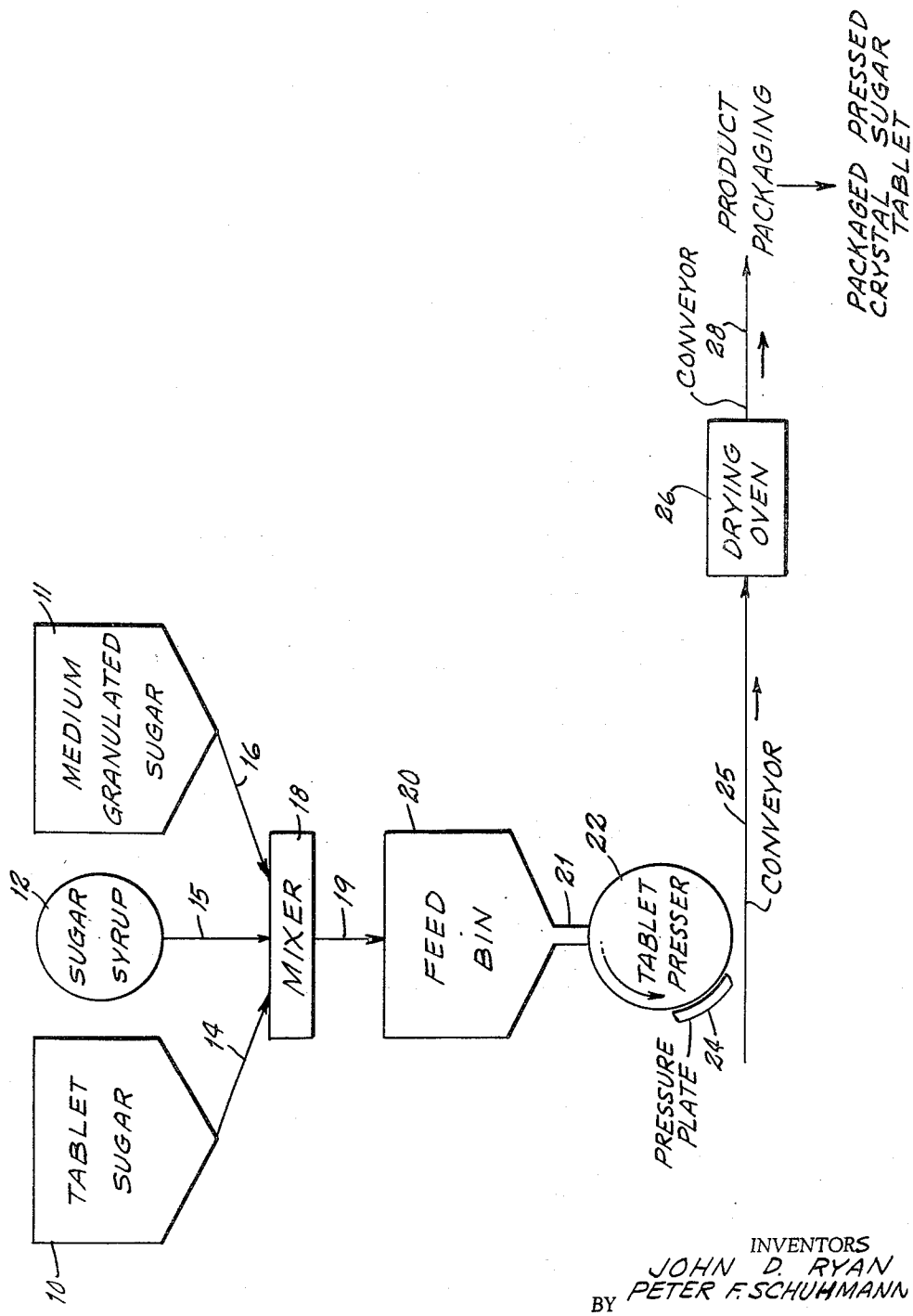
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PRESSED CRYSTAL SUGAR TABLET AND METHOD OF MANUFACTURING SAME

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INVENTORS
JOHN D. RYAN
PETER F. SCHUHMANN
BY
Thomas J. Moran
ATTORNEY

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PRESSED CRYSTAL SUGAR TABLET AND METHOD OF MANUFACTURING SAME

John D. Ryan, Franklin Square, and Peter F. Schuhmann, Oceanside, N.Y., assignors to American Sugar Company, New York County, N.Y., a corporation of New Jersey

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This invention relates to sugar compositions. More particularly, this invention relates to sugar compositions in tablet, cube or other similarly shaped form. Still more particularly, this invention relates to a pressed crystal sugar tablet and method of manufacturing same.

Sugar compositions in tablet or cube form have long been an article of commerce. Ordinary sugar tablets and cubes are prepared by taking pure granulated sugar, after centrifuging, and mixing it with a small amount of colorless sugar syrup. The resulting admixture is then passed to a tableting machine, such as a Hersey machine, wherein the sugar admixture is pressed into tablets or cubes. The resulting formed sugar tablets, after drying, are relatively hard, easily soluble, smooth edged and possess smooth, dull surfaces. Such pressed sugar tablets present surfaces having a dull appearance and completely lack the sparkle of crystal sugar, such as crystal sugar tablets made by the Adant process.

The manufacture of ordinary pressed sugar tablets, however, is a relatively simple and fast operation. It requires only that the admixture of granulated sugar and sugar syrup be supplied to a tableting machine, such as a rotatable cylinder provided with a series of pockets extending inwardly into the body of the cylinder. These pockets serve as molds for receiving the sugar admixture. Slidably fitted within the pocket and constituting the bottom thereof is a plunger which is mounted in the cylinder for reciprocating movement. The arrangement is such that the plunger is advanced toward and retracted away from the concave face of a pressure plate located closely adjacent a portion of the cylinder surface and against which the sugar mixture in the pocket is pressed or compacted to produce the desired shape. The plunger also serves to force out the pressed sugar mixture from the mold or pocket onto a tray or conveyor belt. The resulting pressed sugar tablet is then dried and packaged as the finished product. A more complete description of the operation of a tableting machine is set forth in U.S. Patent 1,836,604.

Crystal sugar tablets made by the Adant process have an appearance strikingly different from ordinary pressed granulated sugar tablets. Crystals sugar tablets made by the Adant process present a rough, uneven surface, are hard and shiny and full of sparkle. In the Adant process course grained magma is transferred directly from the pans into the molds and allowed to cool and harden for about 20–30 hours. The sugar crystals continue to grow while in the mold and at the end of the molding operation large shiny sugar crystals are formed. The molds are then placed in a centrifuge and any excess liquid is spun off. The moist slabs are dried and then mechanically cut to yield as product the crystal sugar tablets which are very hard, uneven surfaced, shiny and full of sparkle.

The manufacture of crystal sugar tablets by the Adant process is an expensive operation because of the number of processing and handling steps involved and due to the losses incurred during the mechanical cutting operation. Breakage during the mechanical cutting operation is substantial and contributes to the cost of the finished product.

It is an object of this invention to provide an improved process for the manufacture of a crystal sugar tablet.

Another object of this invention is to provide a pressed crystal tablet having the desirable properties of and simulating a crystal sugar tablet made by the Adant process.

Still another object of this invention is to provide a pressed crystal sugar tablet prepared from sugars and sugar syrups readily available in a conventional sugar refinery.

Still another object of this invention is to provide an inexpensive, high productivity method for the manufacture of a pressed crystal sugar tablet simulating a crystal sugar tablet made by the Adant process.

How these and other objects of this invention are achieved will become apparent in the light of the accompanying disclosure made with reference to the accompanying drawing which schematically illustrates a process flow and the operational steps involved in the manufacture of the pressed crystal sugar tablets in accordance with this invention.

A pressed crystal sugar tablet in accordance with this invention is prepared by forming an admixture comprising relatively fine, mixed-particle-size or mixed grain sugar, so-called tablet sugar, and medium granulated sugar and a minor amount of sugar syrup. The thus-formed admixture is blended to form a substantially homogeneous mass and pressed into the desired shape, cube form or tablet form and the like. The resulting pressed sugar composition is then dried and packaged as product.

In the preparation of the sugar admixture substantially equal parts by weight of relatively fine tablet sugar and medium grain granulated sugar are employed. The tablet sugar employed is moist, substantially as recovered after centirfuging, having a moisture content in the range 0.8–1.5% by weight, such as a moisture content in the range 0.9–1.2% by weight, usually about 1.0% by weight. The particle size of the tablet sugar employed is such that substantially all, at least about 80% by weight, preferably about 90% by weight, e.g. about 95% by weight, passes through a 20 mesh U.S. Tyler Screen.

The medium granulated sugar employed has a substantially uniform particle size such that substantially all, at least about 90%, passes through a 10 mesh U.S. Tyler Screen and a major amount, at least 50% by weight, such as an amount in the range 60–90% by weight, e.g. about 80% by weight, is retained on a 20 mesh U.S. Tyler Screen.

In the preparation of the sugar admixture generally equal amounts by weight of tablet sugar and medium granulated sugar are employed, such as 100 parts by weight tablet sugar, having a particle size described hereinabove and 100 parts by weight medium granulated sugar having a particle size described hereinabove. Some latitude in the variation of the parts by weight of these sugars is permitted, however, such as 90–110 parts by weight tablet sugar per 110–90 parts by weight medium granulated sugar, respectively.

The sugar syrup admixed with the tablet and medium granulated sugar in the preparation of the pressed crystal sugar tablets in accordance with this invention comprises a minor portion thereof, such as an amount less than about 25% by weight, e.g. an amount of sugar syrup in the range 5–30 parts by weight. Some latitude is permitted in the sugar concentration or sugar content of the sugar syrup employed and the sugar content may range from about 30 to about 80% by weight sugar (sucrose) in the syrup.

Referring now to the drawing which schematically illustrates the practice of this invention, storage bin 10 contains tablet sugar, ordinary pure granulated sugar, having a moisture content of about 1.0% by weight and hav-

ing the following particle size distribution as measured by standard U.S. Tyler Screens.

Mesh:	Percent by weight
20	4
28	34
35	45
48	15
65	2

The tablet sugar in storage bin **10** has a color value in the range 25–30 as measured by a Beckman Colorimeter.

The medium granulated sugar is contained in storage bin **11**. The medium granulated sugar therein is substantially dry and has a particle size distribution as measured on standard U.S. Tyler Screens as follows.

Mesh:	Percent by weight
10	7
14	36
20	45
28	10
35	1
48	1

Like the tablet sugar, the medium granulated sugar has a color value as measured on a Beckman Colorimeter in the range 25–30.

The sugar syrup is stored in tank **12**. The sugar syrup therein is a colorless, twice bone char filtered liquor having a color value of 30–100 and a sugar (sucrose) concentration of 64° Brix, the sugar content having a purity of 99% sucrose based on total dissolved solids.

The tablet sugar, sugar syrup and medium granulated sugar are supplied in regulated amounts, 100 parts by weight, 2 gallons and 100 parts by weight, respectively, via lines **14**, **15** and **16** to mixer **18** wherein they are admixed to form a substantially homogeneous sugar admixture. The resulting homogeneous sugar admixture is supplied from mixer **18** via line **19** to feed bin **20**. The sugar admixture in feed bin **20** is supplied via chute **21** to tableting machine or tablet presser **22**.

Tablet presser **22** may be any suitable sugar tableting machine, such as a Hersey machine. As schematically illustrated tablet pressure **22** comprises a rotatable cylinder having associated therewith pressure plate **24** against which the sugar admixture supplied to tablet presser **22** via chute **21** is pressed or compacted into a desired tablet or cube form.

Following the tablet pressing operation the resulting pressed tablets are deposited on conveyor **25** and passed to oven **26** for drying. Oven **26** is a hot air oven and depending upon the operating temperature, usually in the range 150–190° F., more or less, the residence time of the pressed tablets therein may vary in the range 0.75–5 hours, more or less, before drying is substantially completed. While the pressed tablets are in the drying oven substantially all of the moisture is removed therefrom and additional sugar crystallization from the syrup in the pressed admixture takes place, serving to enlarge the size of the sugar crystals already present in the admixture and to bond or cement the sugar crystals together. Following the drying operation the pressed, dried sugar tablets are removed from oven **26** and passed via conveyor **28** to a product packaging station to produce the packaged pressed crystal sugar tablet. As indicated, all the aforesaid operations can be carried out continuously or, if desired, intermittently.

The following tests are exemplary of the advantages obtainable from the practices of this invention and indicate the superiority of the pressed crystal sugar tablets of this invention over ordinary commercially available pressed granulated sugar tablets and even crystal sugar tablets prepared by the Adant process. The properties tested were sparkle, tablet strength and tablet rate of solution. Tablets tested measured approximately 1⅛" long x ¾" wide x ⅜" thick. The three types of tablets tested

were ordinary pure granulated sugar tablets, such as sugar tablets prepared from tablet sugar having the properties described hereinabove in connection with the drawing, and crystal sugar tablets prepared by the Adant process and pressed crystal sugar tablets prepared in accordance with this invention as described in connection with the drawing. Before testing all the tablets were stored for 24 hours at 70° F. and a relative humidity of 65%.

The sparkle or Lustermeter tests, measurements of specular reflectance of the sugar tablets, were made with the Lustermeter, an instrument developed by Evans Research and Development Corporation, New York, N. Y. The instrument was equipped with a photocell supplied by the Photovolt Company and the reflectance readings were made on the photometric scale of the galvanometer. A microscope lamp was used as the light source. Ten tablets were selected from each of the types of sugar tablets and three readings were made on each tablet. The tablets were placed in the Lustermeter with the rough side of the tablet facing the light source. The results of these tests are set forth in accompanying Table No. I.

TABLE I

Lustermeter measurements of the specular reflectance of sugar tablets

Tablet No.	Average Specular Reflectance (percent) for Sample		
	Pressed Granulated	Adant Crystal	Pressed Crystal
1	24.6	22.5	25.1
2	23.0	20.7	29.6
3	21.2	22.2	23.7
4	16.8	23.7	21.4
5	14.3	19.5	25.2
6	15.7	23.0	25.5
7	13.6	23.3	27.9
8	12.9	21.7	23.2
9	17.0	19.6	23.3
10	14.0	20.5	23.6
Average	17.3	21.7	24.5

These tests illustrated that the pressed crystal sugar tablets prepared in accordance with this invention exhibited superior sparkle or specular reflectance even greater than the sparkle of crystal sugar tablets prepared by the Adant process.

Tests were also carried out to determine the breakage strength of the tablets. In these tests the Dillon tester, with a special attachment for breaking the sugar tablets, was employed. In the tests the tablets, supported along their long axes, were placed in the special attachment of the tester. Breaking force was applied slowly, approximately 250 grams per minute, at the center of each tablet. The results of these tests are set forth in accompanying Table No. II.

TABLE II

Measurement [1] of breakage strength of sugar tablets

Tablet	Force (kg.)	Range (kg.)
Pressed Granulate	4.5	0.3
Adant Crystal [2]	4.7	1.3
Pressed Crystal	8.9	0.8

[1] Averages of three measurements.
[2] Averages of six measurements.

The data obtained in the breakage tests indicated that pressed crystal sugar tablets prepared in accordance with this invention exhibited the highest strength.

The rate of solution of the various sugar tablets was then determined. In these tests a 200 mesh screen basket suspended from a strain gauge was employed to measure the amount of sugar dissolved as a function of time. The sugar tablet undergoing test was placed in the basket and

the basket was immersed in 800 cc. of water at 80° F. The rate of weight loss of the tablet, without stirring, as a function of time was recorded. The results of these tests are set forth in accompanying Table No. III.

TABLE III

Rate of solution of various sugar tablets, percent dissolved

Time (minutes)	Pressed Granulated	Adant Crystal	Pressed Crystal
1	45.7	54.2	16.7
2	66.7	93.7	50.8
3	75.9	100.0	79.4
4	82.9	----------	92.2
5	88.4	----------	97.9
6	93.6	----------	99.7
7	96.0	----------	100.0
8	98.3	----------	----------
9	99.5	----------	----------
10	99.6	----------	----------

These tests indicated that pressed crystal sugar tablets prepared in accordance with this invention exhibited a lower rate of solution, i.e. were more refractory to dissolution than crystal sugar tablets prepared by the Adant process. This property of the sugar tablet is particularly prized by tea drinkers from Eastern Europe who are accustomed to placing a tablet in the mouth and then to drink or sip tea therethrough. When this is done it is desirable that the sugar tablet retain its shape and does not disintegrate in the mouth but allows sweetening of the tea.

The data obtained in the above tests are summarized in accompanying Table No. IV. The data set forth in Table IV clearly indicate the superiority of a pressed crystal sugar tablet over ordinary pressed granulated sugar tablets and crystal sugar tablets made by the Adant process.

TABLE IV

Sugar Tablet	Luster, percent Specular Reflectance	Breakage Strength (kg.)	Time of 90% Dissolution (minutes)
Pressed Granulated	17.3	4.5	5.2
Adant Crystal	21.7	4.7	1.8
Pressed Crystal	24.5	8.9	3.7

As will be apparent to those skilled in the art in the light of the foregoing disclosure, many modifications, alterations and substitutions are possible in the practice of this invention without departing from the spirit or scope thereof.

We claim:

1. A pressed crystal sugar tablet prepared by forming a substantially homogeneous admixture consisting essentially of about 100 parts by weight tablet sugar, about 100 parts by weight medium granulated sugar and an amount of sugar syrup in the range 5–30 parts by weight, said tablet sugar having a moisture content in the range about 0.8–1.5% by weight and having a particle size such that substantially all of said tablet sugar passes through a 20 mesh U.S. Tyler Screen, said medium granulated sugar being substantially moisture-free and having a particle size such that substantially all of said medium granulated sugar is retained on a 20 mesh U.S. Taylor Screen and said sugar syrup being a substantially colorless, aqueous sucrose solution, pressing the resulting admixture into tablet form and drying the resulting pressed tablet form sugar.

2. A pressed crystal sugar tablet in accordance with claim 1 wherein said tablet sugar has the following sieve analysis on U.S. Tyler Screens:

Mesh—	Percent by weight
20	4
28	34
35	45
48	15
65	2

and wherein said medium granulated sugar has the following sieve analysis on U.S. Tyler Screens:

Mesh—	Percent by weight
10	7
14	36
20	45
28	10
35	1
48	1

3. A pressed crystal sugar tablet prepared by forming a substantially homogeneous admixture consisting essentially of about 100 parts by weight tablet sugar, about 100 parts by weight medium granulated sugar and 2 gallons of sugar syrup, said tablet sugar having a moisture content in the range 0.9–1.2% by weight and having a particle size range as measured on U.S. Tyler Screens as follows:

Mesh—	Percent by weight
20	4
28	34
35	45
48	15
65	2

said medium granulated sugar being substantially moisture-free and having a particle size range as measured on U.S. Tyler Screens as follows:

Mesh—	Percent by weight
10	7
14	36
20	45
28	10
35	1
48	1

and said sugar syrup being a substantially colorless, aqueous sucrose solution having a concentration of about 64° Brix, pressing the resulting admixture into tablet form and drying the resulting pressed tablet form sugar.

4. A method of preparing a pressed crystal sugar tablet which comprises forming a substantially homogeneous admixture consisting essentially of about 100 parts by weight tablet sugar, about 100 parts by weight medium granulated sugar and an amount of sugar syrup in the range 5–30 parts by weight, said tablet sugar having a moisture content in the range about 0.8–1.5% by weight and having a particle size such that substantially all of said tablet sugar passes through a 20 mesh U.S. Tyler Screen, said medium granulated sugar being substantially moisture-free and having a particle size such that substantially all of said medium granulated sugar is retained on a 20 mesh U.S. Tyler Screen and said sugar syrup being a substantially colorless, aqueous sucrose solution, pressing the resulting admixture into tablet form and drying the resulting pressed tablet form sugar.

5. A method in accordance with claim 4 wherein said tablet sugar has the following sieve analysis on U.S. Tyler Screens:

Mesh—	Percent by weight
20	4
28	34
35	45
48	15
65	2

and wherein said medium granulated sugar has the following sieve analysis on U.S. Tyler Screens:

Mesh—	Percent by weight
10	7
14	36
20	45
28	10
35	1
48	1

6. A method of preparing a pressed crystal sugar tablet which comprises forming a substantially homogeneous admixture consisting essentially of about 100 parts by weight tablet sugar, about 100 parts by weight medium granulated sugar and 2 gallons of sugar syrup, said tablet sugar having a moisture content in the range 0.9–1.2% by weight and having a particle size as measured on U.S. Tyler Screens as follows:

Mesh—	Percent by weight
20	4
28	34
35	45
48	15
65	2

said medium granulated sugar being substantially moisture-free and having a particle size as measured on U.S. Tyler Screens as follows:

Mesh—	Percent by weight
10	7
14	36
20	45
28	10
35	1
48	1

and said sugar syrup being a substantially colorless, aqueous sucrose solution having a concentration of about 64° Brix, pressing the resulting admixture into tablet form and drying the resulting pressed tablet form sugar.

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CHARLES B. PARKER, *Primary Examiner.*

MORRIS O. WOLK, *Examiner.*