How Sugar is Made in Cuba.

The Soledad, Cuba, sugar plantation has the reputation of being the best managed sugar plantation in Cuba. It produced in 1890, 12,000,000 pounds of sugar, and this year it will probably send to market 14,000,000 pounds. Other plantations largely exceed it in cultivated area and mechanical resources, the Consuelo having a product of 40,000,000 pounds, but Soledad is conducted on scientific principles and with American thoroughness, system and organization, so that there is the greatest saving in the cost of production and the largest margin for profit on the investment. All the improved machinery is here; every time-saving and labor-dispensing device is employed, and the maximum amount of sugar is obtained from the cane at the lowest possible cost. Soledad is largely owned by Mr. Atkins, of Boston, but Mr. Murray, the manager, holds a large interest in it. H. J. Abbott, who was for many years a United States government expert and chemist, and who has been most successful in operating plantations here and in Santo Domingo, and in supplying new and improved machinery for them, pronounces Soledad incomparably the best conducted sugar estate in the West Indies.

At Soledad the cane is carried to the works by long trains running on narrow gauge railways through the estate. It is unloaded from the cars by negroes and thrown upon a broad carrier traveling up a long incline to the rollers of the first mill. As many as fifteen men are employed in handling this moving mass of cane. When it reaches the first mill, it is ground by rollers weighing fifteen tons and set close together. The cane is broken up and about 60 per cent of the liquor which it contains is drawn off underneath the mill. Under the old process there was only one grinding, and much of the liquor was wasted. Now the cane is ground twice and an additional 15 per cent of the juice is obtained. Streams of liquor from the vats of the two mills unite and pass through a strainer, one workman being employed in raking off floating refuse and preventing obstructions. The liquor is then ready to be pumped into the boiling works.

The refuse of the cane after the two grindings is the only fuel used in the works. It is carried by moving conductors to the furnaces and dumped automatically, being dried by the intense heat and consumed as rapidly as it is fed. Wood was used as fuel when the steam engine was introduced in sugar works, and subsequently bagasse, or refuse cane, was put with it. Boilers have been invented to facilitate the employment of bagasse as fuel. Those used here are the Porcupine boilers of the Stillwater pattern. The cane, when fed to the conductors, serves to keep all the complex machinery of the works in operation; the broken and crushed fragments of bagasse are carried to the furnaces and furnish the power by which not only the grinding but also the pumping and boiling are done; all that is not juice, but sheer waste, goes into the production of force by which the mills are kept grinding and the liquor clarified, boiled and crystallized into sugar.

From the grinding mill the cane juice is pumped into defecators, or large tanks, in the upper story of the boiling works. In these tanks it is treated with lime, which neutralizes the acid. The albumen coagulates when the cells are broken by steam and brought to the boiling point. From the defecators the liquid is pumped into the first of three great boilers, or vacuum pans. In order that boiling may take place at low temperatures the air in the pans is exhausted by steam pumps. In the first boiler the temperature is 200 degrees, in the second 180 degrees, and in the third 150 degrees, with corresponding vacuums in each, the heat from the boiling liquor being an agency in the process. This is known as the triple effect of boiling. The liquor is boiled to a sirup containing 50 per cent of water and 50 per cent of sugar. The sugar crystallizes in two large strike pans, where the most delicate work of the factory is done. The most expert operatives are in charge of the strike pans, from which the contents are constantly sampled and tested in the laboratory, conducted here by a most intelligent American, J. G. Lumelius. The sugar is rapidly cooled and carried into a series of centrifugals. In these the sugar is separated from the molasses by the centrifugal process. As the contents revolve about the center, the sugar gradually begins to whiten and the molasses is expelled through holes in the sides. When the process is completed, 85 per cent is sugar and 15 per cent molasses as the result of two boilings. The sugar is collected by machinery, carried to the bagging and weighing rooms, and transported by railroad and steam lighter to the wharves of Cienfuegos for shipment to New York.

The works are in operation at Soledad day and night from December to May, and are then closed until the next grinding season. This is the period when the cane is ripe, and when the juice must be expressed with the least possible delay. Cane that is left too long in the field deteriorates in quality and yields less juices. The cane bears one crop a year, and stands for twelve years. When it is ready for harvest it is cut close to the ground with knives and carried to the tramway cars. The next season the cornlike stalk grows to its full height, and is ready to be cut again and to have its juice expressed. The grinding season is a short one, and there is great danger lest the cane be spoiled by heat or rain. The most intelligent supervision is required in the fields, and the most rapid transportation of the cane to the mills. Both of these conditions are supplied at Soledad. The cane is cut when it is ripe and carried by train to the mills, where it is converted into sugar in a single day.—*N. Y. Tribune.*

The Electric Current.

There are but few people who ever stop to think of the great benefits which they enjoy in this world, says *Modern Light and Heat.* We are all too apt to think our own particular case is a hard one, without realizing that no matter how badly off we are, we have a great many things for which we ought to be thankful. And there are few who realize that the electric current plays the important role that it does in our every-day life. Our streets are lighted by electric lamps, which are discouragers of crime and wantonness and protectors of life and property; we have our police signal and our fire alarm systems, to the latter of which we owe a great deal more than is ordinarily realized. We all know to what great risks our property is always exposed from fire, and how great the need is that every precaution should be taken to secure its immediate extinguishment. For this purpose electricity has furnished the most satisfactory solution of the problem. Our cities are covered with a vast network of wires, signal boxes are located at frequent intervals, from which, when need arises, the warning, and the approximate location of the fire is instantaneously transmitted to the places where the fire apparatus is located. In this field the electric current, with human skill and intelligence, and the assistance of trained animals, affords a protection which no other agent could do.

What Horses Die of.

A New York horse life insurance company, insuring only sound and generally young animals, worth between $100 and $400 each, reports that, of 704 horses dying within the past five years, 183 died of colic, 77 of inflammation of the bowels, 74 of kidney trouble, 51 of pneumonia, 52 of sunstroke, 30 of pinkeye, 37 of lockjaw, 23 of broken legs, 12 of epizootic, 10 of heart disease, 4 of blind staggers, 9 killed by runaways, 4 were drowned, 2 were killed by lightning, 128 died of unknown diseases, and only 8 were burned.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Charles E. Marston, Dover, N. H. This is a boiler designed to take up but little room, while presenting large heating surface and adapted to generate steam very rapidly, being composed of a series of tubes, each connected with the water supply and steam dome, a branch pipe extending from each tube and opening into it near the top and bottom.

ALARM FOR BOILERS. — Frank M. Ashley, Brooklyn, N. Y. Connected at the top and bottom with the boiler is a casing in which is a horizontal cock communicating through a pipe with an alarm, there being an inclosed float attached to a rod having at the top a valve working in a seat in the inclosed horizontal body of the cock, the construction being designed to obviate any sticking or failure of the valve.

ELECTRIC MOTOR.—William M. Dresskell, Brainerd, Minn. Combined with the armature coils is an insulating disk carrying series of contact points connected with the armature coils, two three-armed switch arms being placed on the armature shaft, insulated from each other and from the shaft, and adapted to change the connections of the armature from series to parallel or the reverse for currents of different strength, the motor being adapted for direct or alternating currents.

Railway Appliances.

CAR COUPLING.—Theodore M. Fisher and Alexander Slye, Mecca Mills, Ind. Pivoted in angular braces extending from each side of the drawhead is a lever by means of which the coupling pin may be raised from either side of the car when the link is about to enter the drawhead, springs being arranged to draw the lever downward and cause the pin to engage the link, the device being simple, strong and inexpensive.

CABLE RAILWAY. — George W. Bowman, Denver, Col. By this invention two T-rails are arranged alongside each other to form a cable channel, a swinging drawbar carrying a pilot wheel having a central position fitting between the rails and reduced end portions resting on the rails, in combination with drums and a cable, the pilot wheel serving to steady the car and prevent the cable from being drawn out of the channel before passing around a drum on the car.

Mechanical.

SAW SWAGE. — John Hanchett, Big Rapids, Mich. This is a device of simple and durable construction, in which both ends of the anvil die may be used in swaging, and the die can be readily adjusted toward or from the swage die, whereby all wear on the swage end can be readily taken up, and the die can be taken out at any time for dressing up, the device being well adapted for band saws, circular saws, etc.

SAWING MACHINE.—Benjamin E. and Anderson F. Harreld, Hallowell, Kansas. By this invention a main frame is adapted to carry the operating mechanism and receive and hold the material, while a hinged supplemental frame carries the saws, and is adapted to be elevated to allow the wood to be fed to the machine, which is especially adapted to saw cord wood into pieces of uniform length.

BEVEL.—Alfred M. Brown, Worcester, Mass. This is a tool for carpenters and stair builders, for obtaining a single or double bevel, and also to gauge the length and breadth of the work or as a square, the various adjustments being conveniently and expeditiously made.

FRICTION CLUTCH.—Clarence M. Carhart, Plainfield, N. J. Combined with a pulley having a hub flange is a clamping collar engaging the hub and adapted for contact with the flange, there being a fixed sleeve which is engaged by a cam lever pivoted to the collar, and a shifting mechanism connected with the cam lever, whereby a pulley may be expeditiously and effectively connected with and disconnected from a shaft.

TICKET PRINTING MACHINE —Gideon B. Massey, Mamaroneck, N. Y. (deceased, Sarah R. Massey and Stanley A. Bryant, administrators). This is a machine specially designed to print railway tickets, and has a wheel to receive a number of destination plates, provides for the consecutive numbering of tickets sold, for the keeping of a record thereof, and the printing of a corresponding report, giving the tickets sold to each line station, the machine being quickly and easily adjusted, and positive in its action.

CAN CAPPING MACHINE. — Fernand Saunier, Nantes, France. This is a compact and simple machine, of low cost and economically operated, for quickly attaching caps to the bodies of cans without the use of solder or its equivalent, a perfectly air-tight connection being effected, the invention covering a novel construction and combination of parts.

Agricultural.

PRUNING IMPLEMENT. — John Siebel, Oskaloosa, Iowa. A suitable pole is provided with a removable stock carrying a sliding knife, the stock having a toothed spur through which a shear-cutting blade may slide, with other novel features, designed to form a simple, compact implement, which may be effectively operated with ease and rapidity to remove branches or small limbs without injury to the tree.

FRUIT PICKER'S LADDER — Whiting Arnold, New York City. The ladder is pivoted upon a truck having a windlass, guide pulleys and cables, whereby the ladder may be readily conveyed from tree to tree and conveniently raised and held at any desired inclination without resting against the boughs, the ladder being detachable, so that a longer or shorter ladder may be used, and the picker may work to the best advantage.

INSECT POWDER DISTRIBUTER.—Andy M. Waddill, Jr., Thomastown, La. This invention consists of a handled frame, with a powder box extending through and supported in the frame by springs, the device being specially designed to facilitate the dusting of cotton or other plants to prevent ravages by insects.

Miscellaneous.

SHEARS.—Emil Krusius, Solingen, Germany. By this invention a spring plate is inserted between the members of the shears, the pivot screw passing through an aperture in the plate, to maintain the cutting edges of the blades in proper relation to each other, even when the blades become loose on the pivot.

ICE CREAM FREEZER. — James M. O'Neall, Dallas, Texas. This freezer has a conical outer casing with hinged top and feed hopper, in which is a conical ice receptacle adapted to be conveniently revolved, the cream being taken up and frozen by contact with the revolving cone, from which it is readily removed by a spiral screw conveyer.

METAL CLASPS.—Gardner A. Watkins, Gardner, Mass. This invention relates to a device for assembling metal clasps and holding them in position for use in the process of coupling or splicing splints, cane, etc., in the manufacture of furniture and other articles, and the invention provides means by which the clasps may be automatically fed from the receptacle in which they are held.

HYDRAULIC BEER PUMP. — Joseph L. Shiring, Allegheny, Pa. This invention provides a double-acting pump to force air into casks to discharge the liquid, the pump acting automatically to keep the air up to the standard pressure, means being provided whereby the action of the oppositely moving pistons shall be rendered positive, and they will always operate, irrespective of the muddy condition of the water.

JEWEL CASE. — Hinrich Grohbrugge, New York City. This case is open at one end, and has a spring at the bottom and a latch in one side wall, while a drawer is adapted to engage the spring and latch, the locking mechanism being invisible, and a key not being required to lock or unlock the case.

GATE. — James W. Fisher, Palouse, Washington. This invention provides a novel construction and combination of parts whereby the gate may be conveniently and expeditiously raised when occasion may demand to swing inward and outward over any obstruction, such as drifted snow, etc., while it also has a simple, strong and effective spring latch.

HORSESHOE.—Henry S. Briscoe, Morrisonville, Ill. This is a shoe to be attached to the hoof without the use of nails, a curved clamping bar extending from the sides of the shoe over the hoof, with which is connected an adjustable locking bar extending upward from a lug on the toe of the shoe.

CALENDAR. — Nathan A. Wheeler, Alpowa, Washington. This calendar has the usual stationary numbers, and upon its face are horizontal or perpendicular slides, grooves, or ridges, to support a slip indicating a day, month, or year, the face also having perforations or other provision for holding an indicator thereon, a particular form of frame being provided to encircle a date and prominently display it.

PENCIL HOLDER. — John S. Shaw, Durango, Col. This is a device to be applied to a slate frame, which is made with a longitudinal recess in which is pivoted a spring-actuated receptacle, forming a convenient pocket in which the pencil may be held, and permitting its convenient insertion or removal.

LETTER BOX. — Francis Catudal and Elzear Drolet, Clyde, Kansas. This box has a drop lid opening outwardly, an interior tray opening downwardly, links connecting the lid and tray, a cam lever acting on the lid to open it, and a detent for the lever adapted to hold the lid open temporarily, the box being designed for use by merchants, etc., to receive mail or other matter and hold it safely until removed.

CASH DRAWER AND RECORDER.—William Assheton, Baltimore, Md. This is an improvement in that class of devices in which a strip of paper is caused to move under a partially glazed opening, and the amount of the sale being first written upon the paper, the paper is fed forward under the glass as the drawer is opened to deposit the money, so that the record of the amount cannot be tampered with.

LOCK.—Benjamin Edwards, New York City. This is a lock to which a key cannot be fitted unless the mechanism is exposed, thus preventing the lock from being skeletoned or picked, the lock being also constructed for a variety of keys, so that the key of one lock will not fit another lock differing therefrom in the slightest degree in any of its operative parts.

SHEATHING VESSELS. — Franklin Ewing, Jr., Atlantic Highlands, N. J. This invention covers an apparatus for applying sheathing to hulls, comprising clamping plates or jaws to secure the apparatus to the beam, a lifting screw, and an arm carrying a pressure screw at right angles to the lifting screw, the arm and pressure screw being adjustable to different positions. The invention is also applicable for joining the timbers of the hull, and otherwise facilitating its construction.

ORE WASHER. — Samuel C. McLanahan and William F. Kirk, Hollidaysburg, Penn. This invention consists in the peculiar construction and arrangement of the journals, journal bearings, and end plates of the washer box, whereby the renewal of the bearing surface, when worn, may be more easily effected, and also in the special construction of a flanged journal, a sleeve for the end of the shaft, and stirring blades attached to the sleeve.

OIL CUP. — Charles H. Baker, New York City. This is a device designed more particularly for wagon hubs, the exterior being screw-threaded to screw into the hub, while in the inner cap is a screw rod with a point adapted to close more or less wholly the feed aperture, and thus control the supply of oil to the axle.

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LEAK DETECTOR FOR PIPES.—Andrew H. Brown, New York City. This invention relates to an improvement on a former patented invention of the same inventor, by which the accumulating water actuates a valve so that an annunciator is sounded, the improvement providing for the continuous sounding of the alarm until the leak is repaired.

HEATING AND VENTILATING BUILDINGS.—Donald Andrews, Lockport, N. Y. Air passages are, by this invention, arranged in the walls of the building and connected at their lower ends with a fresh air passage led over coils of incased heating pipes, foul air discharge pipes being also arranged in the walls, and both passages being broken up by numerous small registers, to constantly remove vitiated air and supply pure heated air.

BAIL LOCK.—William Boyrer, New York City. This is a device designed for use on pots, kettles, etc., to hold the handle off the hot body part, and consists of a clamp adapted to clamp on one of the ears and a swinging arm pivoted on the clamp and adapted to engage the bail or handle.

BUCKLE CONNECTION.—Anthony Biesen, Merrill, Iowa. For connecting a buckle and strap this invention provides a plate having its two ends adapted to be bent parallel and clinched together, there being formed integral with the plate a loop or keeper for the free end of the strap, making a strong and cheap way for connecting a buckle and strap without doubling the strap and sewing or riveting it.

HORSESHOE.—Thomas L. Tipton, Jerusalem, Ohio. This invention relates to what are styled "rolling horseshoes," used on the front feet of fast horses, and is made to turn both down and up at the heel, with a slight bevel outward on top from the heel nails back to the point or ends of the heel, to provide for the widening of the hoof's heel ends.

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FEBRUARY NUMBER. (No. 64.)

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2. Colored plate representing an attractive residence at Auburn Park, Chicago. Cost $7,000. Floor plans, perspective elevation, etc.
3. Plans and perspective view of a carriage house erected at South Orange, N. J., at a cost of $2,700 complete. H. H. Holly, Esq., architect, New York.
4. A residence at South Orange, N. J. Cost $11,000 complete. Perspective elevation, floor plans, etc. Architect, H. H. Holly, New York.
5. Handsome residence of Gothic design at Germantown, Pa., erected for Mr. B. P. Wilson. Perspective elevation and two floor plans.
6. Cottage in Sophia Avenue, Chicago, estimated cost $2,800. Floor plans and perspective elevation.
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8. A colonial residence erected at South Orange, N. J., from plans by Rositter & Wright, architects, New York. Cost $17,000 complete. Perspective elevation and two floor plans.
9. Cottage at Austin, Chicago. Estimated cost $3,700. Floor plans, perspective view, etc.
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Barrel, Keg, and Hogshead Machinery. See adv. p. 30.

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References to former articles or answers should give date of paper and page or number of question.

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Minerals sent for examination should be distinctly marked or labeled.

(2827) **Amateur asks: 1. What tools or** instruments are needed in the finding or searching for minerals of any kind? A. The daimond drill is used for prospecting on the large scale. A mineralogist for field work needs a hammer and chisel. See our SUPPLEMENT, Nos. 200 and 453. 2. Where is the nearest place to look for minerals, in this vicinity? That is for specimens for a collection. A. Bergen Hill: where any blasting is in progress is a good place. You will find most minerals in the metamorphic and primitive rocks. On Staten Island in the serpentine localities, good specimens are often found. See SUPPLEMENT, Nos. 344, 349, and 363. 3. What are the names and properties of the inclosed minerals? A. No. 1 is slag from some furnace or crucible. No. 2 is gypsum. No. 3 is agate. The U. S. Geological Survey may be addressed on the subject of mineral localities. Good works on mineralogy always give localities. Dana's "Mineralogy" is the *sine qua non* for American collectors. We can supply it for $10. Dana's "Manual" and "Text Book" are $2 and $3.50 respectively.

(2828) **W. A. M. asks: At what height** must I cut a tree off, the height of which is 58 feet, so that the stump will form the perpendicular and the top the hypotenuse of a right-angled triangle, the base of which is 30 feet? A. Let x=altitude and y= hypotenuse of triangle. Then by the conditions of the problem we have: $x+y=58$ (1) $y^2-x^2=30^2$ (2) $\therefore x=58-y$. Substituting this value of x in equation (2) we have $y^2-(58-y)^2=900$.

Reducing, $116\,y=4264$
$y=36{\cdot}76$ feet
$x=21{\cdot}24$ "

Or the tree must be cut 21·24 feet from the ground.

(2829) **J. G. asks: 1. Please say how** many cables there are laid from Great Britain to America? A. See for full account of transatlantic cables our SUPPLEMENT, No. 747. 2. How long is it supposed to take after you telegraph the first word of a message before it is received, from the nearest point of this side of the Atlantic to the other? A. About three seconds is given as the time of transmission of an electric impulse.

(2830) **J. F. F. asks how horn comb** manufacturers flatten or straighten cow horns, so that dampness will not curl them. A. All manipulation of horn in the way of bending is done by heat and pressure. When bent or straightened hot and kept in shape until cool, dampness will have little or no effect on it. Hot water may be used as the heating agent.

(2831) **J. E. R. asks for the manufacture** of what is known as celluloid collars and cuffs. A. Celluloid collars and cuffs are rolled, stamped or pressed into shape while warm. The exact details of the process are not published. A muslin backing may be used to give grain. The rolls, etc., are kept hot by steam, gas flame, or otherwise. The main portion is a sheet of celluloid charged with zinc oxide.

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