

the juice clear. As straining the juice from the lime is always a very troublesome operation, the more of this clear juice you can get the better; but even when drawn off clear, it should always be strained through a lime strainer, but when clear it passes readily. When you come to the thick portions, and to the scums, they may be put into close canvass bags, and with boards between, as in the first press; when the roots are grated; pile the bags one on the other, and let the liquor exude through the bags by the pressure of their own weight; it will come through clear, or, at all events, so clear as to be easily strained. As the liquor ceases to run, pile weights on the bags, and in the end press them with the screw. The thick portions are most valuable manure. No mischief will arise from delay in this part of the process, as the lime will prevent the juice from soiling or fermentation for any reasonable time.

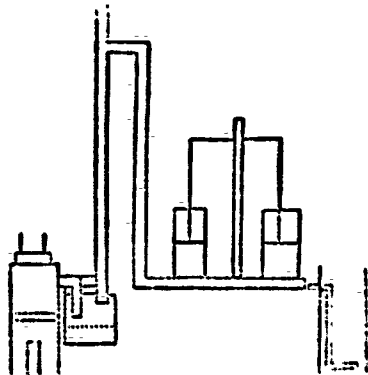
When the juice is all clear and fine it is then ready for the next process, which is called the carbonation.

Although the juice is so clear and fine, there is still a great deal of lime in it, although you cannot see it—the sugar in the juice renders the lime in a measure soluble.

The lime which is in the juice is in a caustic state, and the object of the next operation is to remove the causticity; when this is done, the lime (before invisible) at once subsides in the liquor, and is removed by settlement and filtration. This operation is called the carbonation, and is done in the following manner:—

It must first, however, be remarked, that on the perfection of the carbonation, the whole success of the work will depend, and too much pains must be taken in rendering this part of the process complete and easily worked.

You must procure or construct a stove for burning charcoal thus:—(See the accompanying cut.)



A is the chimney of a stove, made of either cast iron or brick, with a fire grate and ash pit, and the means of putting in the charcoal at the top, and then covering up the opening. B is a pipe, made of common stove pipe iron. C is a tub containing water, with a cover fitting over of either wood or iron—iron is best and safest of course. The cover has two holes in it, into which the stove pipes fit tight. The pipe which comes direct from the stove must go down to within an inch of the water, but must not touch it. The water is to catch and retain the dust and ashes, which would otherwise pass over from the burning charcoal; the other pipe only goes just through the cover, the joints of both these pipes where they enter the cover should be made as tight as possible. There should be a common stove damper at E, turning on a centre. When you kindle the fire of charcoal in the stove, shut this damper, and let the first fumes of the charcoal and the smoke pass off into the air. As soon as the charcoal is well lighted, and the smoke and bad smell have passed off, the damper must be opened, and the cover of the stove closed, and the fumes of the burning charcoal must be sucked through the second pipe in the following manner:—

You must have a set of bellows; (common blacksmiths' bellows will answer if made large enough, or a blowing cylinder similar to those used in foundries will do even better) these must be connected with the second pipe by a flexible joint made of leather or otherwise, and there must be the means of readily working them either by hand power or machinery. To the nozzle of the bellows is fixed a flexible rubber pipe, so that when the bellows are worked, the gas from the charcoal is drawn through them, and forced through the flexible pipe. At the end of this flexible pipe is fixed a rose or a pipe pierced with small holes, and heavy enough to sink

into, and keep at the bottom of the liquor. The second pipe (B) from the water vessel must be made of sufficient length to allow most of the heat to pass off before it comes to the bellows or blowing cylinder, or you will burn your bellows and leather joint and valves. If the joints of this pipe are not tight enough, paste them up with paper until they are tight.

Having this all in order, (and it must be thoroughly well done) insert the flexible pipe which is attached to the nozzle of the bellows into the liquor to be carbonated, and blow away. The passage of the carbonic acid gas from the charcoal, passing through the limy liquor in fine streams or bubbles, mixes with the lime in the juice and carbonates it, and the lime (on the liquor being rested) falls to the bottom of the vessel in a fine mud.

To prove when the carbonation is complete, take a small quantity of the liquor in a glass, (get it as fine as possible, or filter it), then with a straw or reed, or other pipe, blow your breath through the liquor in the glass. If it remains fine, the work is done; if the breath muddies the liquor, the carbonation is not complete, and the bellows must again be worked until the liquor, when tried, is found to remain bright and clear. When blowing the breath through the glass of liquor you must hold your nose, or else the breath will not have sufficient carbonic acid in it to prove the liquor.

The carbonation must be done when the liquor is only just warm enough to keep grease melted on it—the generality of the books desire the carbonation to take place in boiling liquor—but this is a grave error, as will be shown further on. Carbonic acid has the effect on hot juice of destroying the crystallizing power of the sugar. When the carbonic acid gas from the charcoal is blown into the liquor, a great deal of effervescence will take place; and the only way to keep down the froth is by the addition of a small portion of clean grease—the less, however, the better. When the carbonation is complete, the liquor must be allowed to settle for a short time; the clear liquor must be strained into the boiler, and the sediment must be squeezed and filtered. The residue is most valuable for manure.

As, however, you have now lost the preservative power of the lime, the liquor will rapidly ferment, or sour, and no time must be lost in transferring it to the boiler, and getting it hot. It must be boiled until about one-fourth of it is evaporated, and it must then be strained through the bone black filter, which will be described further on.

It will come through the bone black of a very much lighter color, and almost free from disagreeable taste and smell. It must then be boiled down to a thick syrup, taking care not to burn it, and it will be ready to set by, in a warm place, to crystallize.

As the boiler is so important a part of the machinery for sugar making, it is well to describe it more particularly. Any kind of boiler will answer, such as sugar kettles, set on an arch, or otherwise, but the writer prefers the following—more particularly because experience has shown, in the Western States, that it is admirably adapted for the purpose. It is made very cheaply, is very lasting, and is extremely economical in fuel.—The shape of the boiler is long and narrow, and the heat of the fire acts on the entire length of the bottom. The sides and ends of the boiler are made of two inch pine plank, fastened together at the angles with screws, and angle pieces of wood, the screws going both into the ends and into the angle pieces. Into the side pieces there are grooves cut one-and-a-half inches wide, and one fourth of an inch deep. These grooves must be carefully cut—all exactly to one size—and well and smoothly finished, so that the partitions (to be hereafter described) will all fit into every groove. If this is not carefully done there will be endless trouble. The grooves must be eight inches apart. In making the frame the ends must not come down as low as the sides by two inches. The frame must be twelve feet long, and at least two feet wide. The bottom is made of two sheets of iron, rivetted together at the ends, so as to be water tight. It must be turned up at the ends and sides, and the angles turned in just like a large baking dish; but the ends must turn up three inches longer than the sides. Holes must be punched or drilled all along the sides and ends of the turn up, for the purpose of putting in screws to hold the iron to the wood. The turn up should be two inches at the sides, and five inches at the ends. You then have a long, shallow, iron dish—the wooden frame is made to fit into this—and then the sides and ends of the iron pan are fastened strongly into the sides and ends of the frame.

The partitions are made of wood, eight inches broad, and slide easily into the grooves. On to the lower side of each partition a piece of two-inch

strong iron hoop is fastened, by screws; but this iron, although it goes quite to the end on one end of the partition piece, does not go to the other end by two inches. When the partitions are fitted into the grooves, this vacant space is put alternately at each side, and the iron pieces bear on the bottom of the pan, so that when liquor is poured into one end of the pan it must circulate backward and forward, from side to side, until it reaches the other end.

When the boiler is to be used for heating and defecating the juice, these partitions are taken out, and laid aside; they are only used during the process of evaporating the juice previous to crystallization.

This boiler is set on two walls of brick work, going its entire length. The fireplace is at one end, and the chimney at the other.

When you are evaporating or sugaring off, the partitions must be fitted into their places; there must be two vessels or tubs used with the boiler, one placed near the chimney to hold the charge; the other, at the fire end of the boiler to receive the syrup. There is a tap hole or plug in the end of one of the sides of the boiler to draw off the charge, this must be capable of being partially or wholly closed as required. A sufficient stream is let into the boiler at the chimney end, so that it evaporates as it runs from side to side; and is finally discharged from the fire end in the shape of thick syrup.—When all is done, this syrup is removed to the chimney end, and again made to flow through the boiler, when it comes out all the water evaporates and is fit to sugar off and go into the crystallizing pans. In this state it will keep any length of time without fermentation or change.

The fire must be used with care and judgment, and for sugaring off, a sheet iron plate ought to be used to slide in between the bottom of the pan, and the fire; and thus take off the rashest heat of the fire, and prevent burning.

Before however the syrup is boiled down, to its thickest state, it must be strained through a filter of bone black, which we shall now proceed to describe, this is the most troublesome part of the process from the fact, that the bone black filter will only last a short time, without being returned.

Bone black acts much more energetically on juice about one-quarter boiled down, than on syrup, therefore the filter should be used whenever the juice has been well boiled, and has been thus only in a measure evaporated, the bone black filter operates better on the hot juice than on cold, and where it can be done, the juice as well as the filter ought to be kept hot throughout the entire process of filtering.

The object of the bone black filter, is to take out the excess of lime, and the other alkaline salts in the juice, and also to purify the syrup from its bad taste; and to destroy its color. A certain portion of the sugar can be crystallized without the bone black, but the bone black should always be used where it is possible to use it.

The Bone Black Filters.

Any one who has a potash kettle can make bone black, and can return the bone black when necessary, we shall describe the process with a potash kettle, leaving those who have not one to use some substitute which their own ingenuity must point out. Any thick cast iron vessel that will stand a red heat time after time, will answer, though of course not so well as a potash kettle. The regular sugar manufactories have proper machinery for this purpose, we only wish to point out the substitutes.

Collect all the bones together you can; break them up small, and fill them into the potash kettle, boil them well, steaming is better—and skim off the fat—when they are quite clean from fat, &c., and the water has been drained off, take some wet clay, cover over the bones with the clay, and apply heat, this must of course be done out of doors, and away from the house, as the fumes will be very offensive; it should also be done out of a building; as the fat in the bones which cannot be got rid of by boiling will generate a great deal of gas as they are heated, this gas will catch fire, and burn with violence, all danger from this source must therefore be guarded against. The fire under the kettle must be urged until every thing is red hot, and until the bones are all burned, and no further smell comes from them. It would be all the better to have a fire over as well as under the kettle, but the ashes from the fire must not be allowed to get into the bone black, if any does, it must be carefully washed out, but no ashes must get in. When every thing is red hot, and the bones so well burned that no more smell or gas comes from them; cover up the whole with good clean clay earth, and let it cool, the wet clay first, and the clay earth afterwards, are to keep the external air from affecting the burning bones, if it was not for this, you would not have "bone charcoal;"