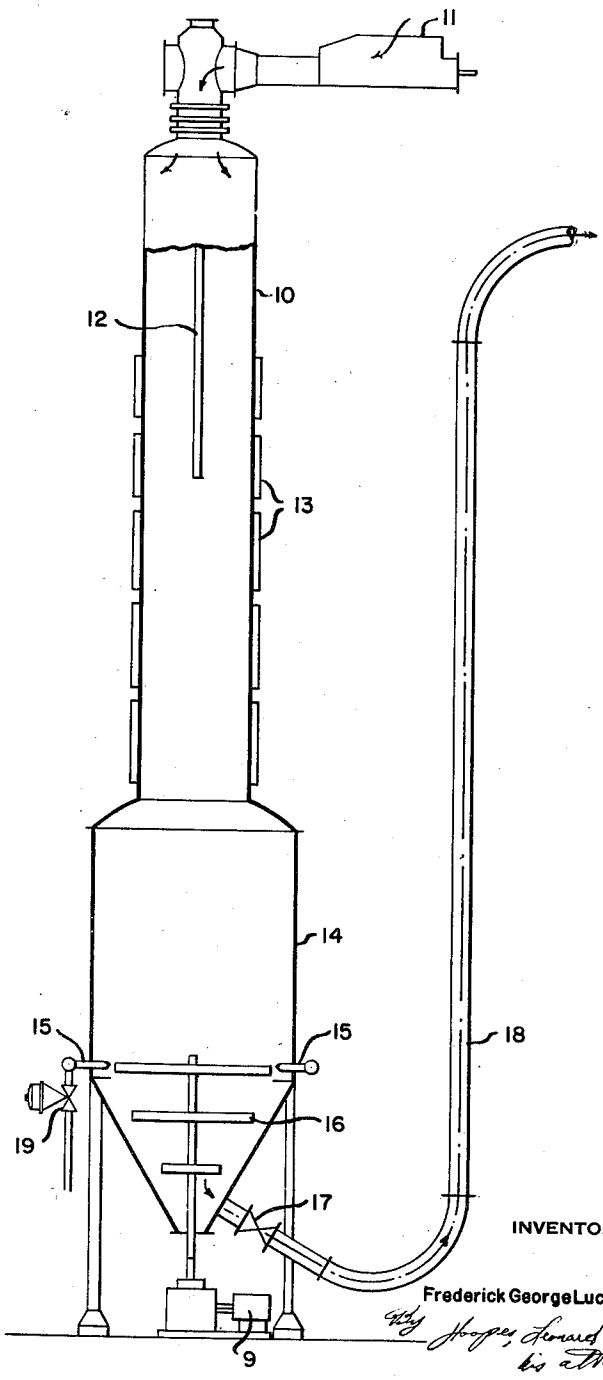
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PROCESS FOR THE CONTINUOUS TREATMENT OF VEGETABLE FIBERS

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PROCESS FOR THE CONTINUOUS TREATMENT OF VEGETABLE FIBERS

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Continuation of application Serial No. 119,699, October 5, 1949. This application January 12, 1954, Serial No. 403,518

2 Claims. (Cl. 92—7)

This application is a continuation of application Serial No. 119,699, filed October 5, 1949, now abandoned.

This invention relates to processes and apparatus for the continuous treatment of vegetable fibres of the kind in which the fibres mixed with a treating liquid are arranged to descend through an upright tower and are withdrawn from the bottom of the tower and the invention is particularly concerned with the kind of process in which the treatment is carried out under elevated temperature and for this purpose the height of the tower is so selected that the pressure near the bottom corresponds to or is greater than the vapour pressure of the treating liquid at the required temperature. A process of this latter kind is described in British patent specification No. 536,339.

In order to facilitate the withdrawal of the treated material at the required rate and under considerable pressure which prevails at the bottom of the tower, means are described in this earlier specification for counterbalancing the pressure and for withdrawing the material at a required rate through the counterbalancing means.

An object of the present invention is to provide an improved control for the rate of withdrawal of the treated material from the bottom of the tower.

According to this invention, a process for the continuous treatment of vegetable fibres of the kind first referred to above is characterised in that added liquid is pumped into the tower at or near the lower end thereof and in that the descending material, at the locality of the introduction of the added liquid, is strenuously agitated therewith and is then withdrawn from the bottom of the tower.

A method of continuously digesting vegetable fibrous material with a treating solution, such as caustic soda, sodium sulphite, sodium sulphide or other known digesting solutions consists in causing the vegetable fibres mixed with the treating solution to descend through an upright tower open or closed at the top and heating the mixture during descent to a temperature exceeding 100° C., introducing water or spent digesting liquor at or near the bottom of the tower effecting agitation of said liquor with the vegetable material and withdrawing the resulting mixture, the height of which tower is sufficient to enable pressure to be built up at or near the bottom thereof corresponding to the vapour pressure of the solution at said required temperature.

The upright tower may either be open or closed at the top and there are provided means for introducing the material to be treated and the treating liquid at the top of the tower, means for heating the material during its descent through the tower, means for introducing additional liquid at or near the bottom of the tower, means for agitating the material with the introduced liquid and means for withdrawing the resulting mixture from the bottom of the tower, the height of which tower above the locality of said liquid is sufficient to enable a pressure to be built up corresponding to the vapour pressure of the

liquid at a temperature at which the material requires to be treated.

The means for withdrawing the material mixed with the added liquid may comprise a regulating valve with or without an associated balancing column.

The aforesaid agitating means may comprise a rotor mounted to rotate about an upright axis and having outwardly radiating arms. Preferably, the added liquid is arranged to be introduced at a level opposite the uppermost radiating arm.

The lower part of the tower in which said agitating takes place is preferably of larger diameter than the upper part of the tower. The heating means may comprise jackets surrounding the upper part of the tower, the diameter of this part of the tower being determined by the rate of heat transferred from the steam jackets to the interior and may be between 5 feet and 10 feet in diameter, while the lower part of the tower may be up to 20 feet in diameter, whereby the capacity of the tower, as a whole, is greatly increased. It is found in practice that the compact mass of fibrous material uniformly descends the smaller diameter portion of the tower and on reaching the bottom part thereof uniformly expands as it enters the wider portion. The material is retained in this wider portion while cooking continues, and preferably the walls of the larger portion are heat insulated by suitable lagging.

The following is a description of one form of apparatus suitable for digesting such material as cut grass, esparte grass, cereal straw, bagasse, bamboo etc. reference being made to the accompanying drawing, which is a diagrammatic vertical section through the apparatus.

The upper part of the tower **10**, which may be closed at its top, is fed with the material to be treated by feeding apparatus indicated at **11**. This upper part of the tower may be of from 5 to 10 feet in diameter and from 20 to 100 feet or more in height. The treating liquid such as caustic soda, sodium sulphite, or sodium sulphide, may be mixed with the fibres in the feeding apparatus **11** and may also be introduced through the top of the tower through nozzles (not shown) in proportion of about 3 or 4 of the liquid to 1 of the vegetable fibres. Steam may be introduced into the upper part of the tower through the pipe indicated at **12**. Alternatively, or additionally, the material in the upper tower may be heated by steam jackets **13** which encircle the walls. As the material descends the tower it reacts with the treating solution and forms a compact mass, the temperature of which is progressively raised by means of the steam jackets around the walls until, in the case of a tower closed at the top, it reaches a temperature at the lower end corresponding to or slightly greater than the vapour pressure of the liquid at the lower end, or, in the case of a tower open at the top, it reaches a temperature slightly less than that corresponding to the vapour pressure. The upper part **13** of the tower opens into a base portion **14** of larger diameter and which may be up to 20 feet in diameter, whereby the capacity of the tower, as a whole, is greatly increased. The compact mass of fibrous material upon entering the base portion expands uniformly so as to fill it. The walls of this base portion may be well lagged so that cooking of the material continues as the material passes through it. It is thus possible to provide a digestion unit of larger capacity than was formerly possible, without greatly increasing the height of the tower. The base portion is conically shaped at its lower end, and located in this end is an agitator **16** comprising an upright shaft carrying a number of outwardly radiating arms. Dilution water is introduced at approximately the same level as the uppermost radiating arm of the agitator **16**. The rate of flow of the dilution water is controlled by a suitable pump **19**. The solid content of the ma-

terial above the agitator may be between 20% and 10%, whereas after the material is mixed with the liquid added by the nozzles **15** the solid content may be 6% to 2% or any desired lesser consistency whereby an aqueous suspension is formed which may be removed readily from the system through a regulating valve **17**. The cooked fibrous material above the water inlet **15** remains in the form of a compact mass so that the added water does not travel more than a foot or so above the inlet **15**. In the case where the added liquid is cold water this has the effect of cooling the cooked material. If recirculated, spent or black liquor from a subsequent washing process is employed a heat exchanger may be provided for cooling recirculated black liquor.

It will be appreciated, however, that other forms of agitators may be employed. For example, the agitator might comprise a flat disc provided with a number of vanes. In this case, the disc would require to be rotated at a higher speed than the agitator first described and would be disposed at about the same level as the nozzles **15**. The diluted pulp in such an arrangement would be extracted just below the disc and the bottom of the tower, instead of being conical could be of dished shape.

To simplify extraction and to avoid any tendency for the valve to choke, the pressure on either side of the regulating valve **17** may be balanced by connecting the outlet side to an upwardly-extending conduit **18** through which the diluted material is passed through the plant.

The rate of extraction of the material through the valve **17** may be automatically controlled in accordance with the power absorbed by the agitator. For example, if the pulp becomes too thick, the agitator will absorb increased power, which may be registered on an ammeter in circuit with the electric motor **9** driving the agitator. As the ammeter reading increases the water valve **19** is opened, thus allowing more dilution water to be introduced into the tower. This may be effected either by an operator watching the ammeter or by means of an electro-magnetic control associated with the valve **19**, which control is operated by change of electric current flowing to the motor. Conversely, if the pulp becomes too diluted, the rate of flow of the dilution water may be reduced. It is found in practice that where the tower is operated continuously with one type of raw material, the dilution water may be quite easily regulated by hand in accordance with the ammeter reading, but any one of the known automatic control devices may be used for that purpose.

What is claimed is:

1. A method of continuously digesting vegetable fibrous material with a treating solution which consists in causing the vegetable fibers mixed with a suitable reagent under elevated temperature to continuously descend under gravity through an upright tower thereby rendering the impurities in the fibers separable, continuously agitating the mixture near the bottom of the tower at a pressure which is at least equal to the vapor pressure of the treating liquid at the elevated temperature and which is solely provided by the height of the material in the tower and continuously introducing diluting liquid at the top of the zone of agitation and varying the rate of introduction of diluting liquid in accordance with the consistency of the mixture.

2. A method of continuously digesting vegetable fibrous material with a treating solution which consists in causing the vegetable fibers mixed with a suitable reagent under elevated temperature to continuously descend under gravity through an upright tower thereby rendering the impurities in the fibers separable, continuously agitating the mixture near the bottom of the tower at a pressure which is at least equal to the vapor pressure of the treating liquid at the elevated temperature and which is solely provided by the height of the material in the tower, measuring the power required for agitation of the mixture and introducing diluting liquid into the agitated mixture at a rate which is varied in accordance with the power required for agitation of the mixture whereby to maintain the mixture as an aqueous suspension which is readily continuously discharged.

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