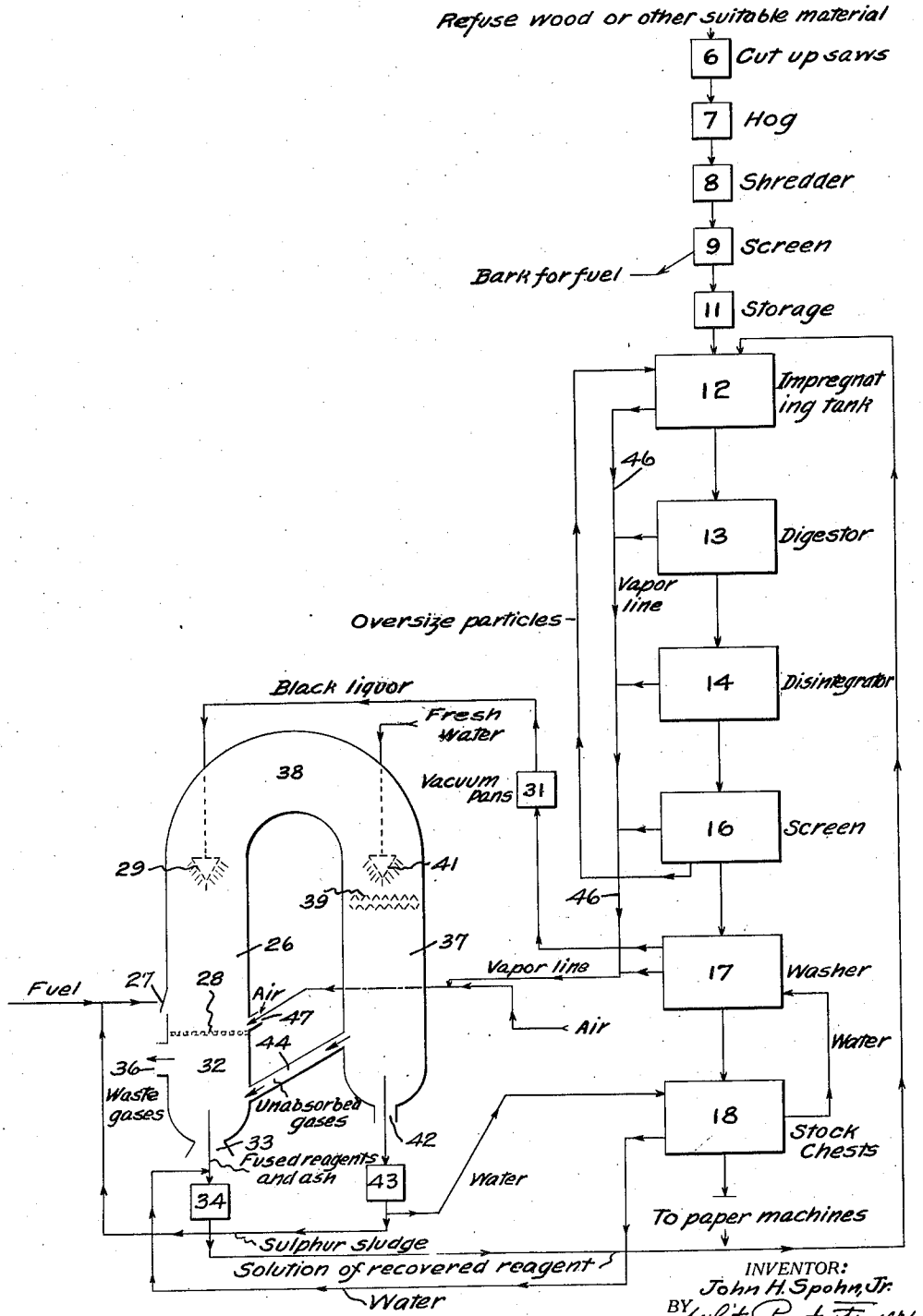
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PROCESS AND APPARATUS FOR MANUFACTURING PAPER

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PROCESS AND APPARATUS FOR MANUFACTURING PAPER

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In the manufacture of paper pulp by the so-called sulphate or kraft process, the delignification of the cellulose material is normally accomplished by a solution consisting of from 4 to 6½%, by weight, of sodium hydroxide and 1½ to 4%, by weight, of sodium sulphide. The cellulose material is subjected to the action of this solution for five to seven hours, while heated under seventy or seventy-five pounds pressure. The action taking place is termed "digestion" and the container wherein the cellulose is processed is termed the "digestor". The digestion is usually accompanied with the formation of various obnoxious gases. When the digesting action has proceeded to the desired degree, the fibrous pulp is separated from the solution (now termed "black liquor"), washed with water and subjected to further processes of the paper making art.

The black liquor is then subjected to a recovery process whereby the sodium salts are recovered from the solution. This is usually accomplished by concentrating the solution and finally incinerating the concentrated mass. During the incineration, strong smelling objectionable odors may be given off. It is usually necessary to add some sodium sulphate as makeup before the incineration takes place. The sodium sulphate is acted upon by hot carbon present to form sodium sulphide. After incineration, the fused salts are lixiviated, the sodium hydroxide being recovered as sodium carbonate. The solution must then be recausticized by mixing with milk of lime (calcium hydroxide), the calcium carbonate formed precipitating.

The loss of the desirable sodium salts and sulphur throughout the process usually amounts to about 15%. The major portion of this loss usually occurs from the volatilizing of the salts during the calcining of the black liquor and in the amount retained by absorption in the precipitated lime. The minor portion is usually lost due to some of the solution being retained in the pulp fibers and through leakage.

An object of the present invention is the production of a pulp stock suitable for making paper or any other product wherein cellulose fibers are used, by digesting the raw fibrous material with substantially sodium sulphide alone.

A further object of my invention is the minimizing of the loss occurring during the process from vaporization of the chemical reagents used.

Another object of my invention is the recovery of the chemical reagents vaporized from the solution during the process and which are ordinarily lost to the atmosphere.

A further object of my invention relates to the recovery of the chemical reagents volatilized during the calcining of the black liquor.

A further object of my invention relates to the removing, from the vented products of combustion, of the obnoxious gases arising from the ignition of the organic matter in the recovery process.

Another object of my invention is to lower the pressure and length of time required to secure the desired degree of delignification of the pulp stock.

A further object of my invention is to control the obnoxious gases attendant upon the digestion process.

My invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full the preferred form of the process of my invention.

In the accompanying drawing the figure is a diagrammatic representation of the process herein considered, with a schematic view of the furnace used in the recovery of the chemical reagent.

My process is adaptable to many fibrous vegetable materials but I shall describe it with reference to the processing of a refuse wood.

In a paper manufacturing process the pulp stock is prepared by suitable means, being preferably mechanically disintegrated to small bits. In the drawing, I have indicated the preparation of a refuse wood by means of the cut up saws 6, a hog 7, a shredder 8,

and a screen 9, where the bark is removed to be used for fuel. The prepared stock then passes to the storage bins 11, or directly to an impregnating tank 12.

In my preferred process, the prepared pulp stock is first impregnated with substantially a sodium sulphide solution for several hours in the impregnating tank 12. The strength of the solution used varies with the nature of the pulp stock and the delignification required. Usually a 5 to 10% solution is used although with some materials it may be necessary to increase this percentage. When the pulp stock has been impregnated to the desired degree, it is digested under steam pressure for a period varying from fifteen minutes to an hour, depending upon the degree of delignification required, in the digestor 13. The pressure is preferably held at from 1 to 10 pounds, although on some pulp stocks it may be necessary to increase it to from 30 to 50 pounds. After digestion, the pulped stock is run to a disintegrator 14, where the cooked strands or chips are further disintegrated, if the degree of digestion desired is such that complete pulping has not been secured during the digesting process. The stock is then screened on the screen 16, the oversize particles being returned to the impregnating tank 12, and the desired pulp run to the washers 17. Here the black liquor, containing the spent sodium sulphide and the products of delignification, is separated from the pulp stock.

The pulp stock, after being washed with water in the stock chests 18 to free it substantially of remaining black liquor, passes on to the usual paper making processes.

The black liquor, separated from the pulp at the washer or diffusion battery 17, contains some residual sodium sulphide and various organic sodium and sulphur containing compounds resulting from the delignifying of the pulp stock. It is desired to recover this residual sodium sulphide and that portion of the reagents which has combined with the organic compounds during the delignification. This is accomplished by concentrating the liquor and burning off the organic matter present in some convenient manner and recovering the smelted reagents. In the following paragraphs I will describe a preferred manner of effecting this recovery.

As shown in the figure of the drawing, a furnace chamber 26, constructed of suitable material to resist the heat and chemical action of the recovery process, is provided wherein a combustible organic fuel, such as waste wood refuse, may be burned. The doors 27 are provided for firing the furnace and for regulating the draft. A grate 28, provides a support for the burning fuel and organic matter in the furnace. In the upper portion of the furnace chamber is a suitable injector for discharging the black liquor into the combustion zone of the furnace, preferably an atomizing nozzle 29.

The black liquor is drawn directly from the process or from suitable storage facilities. I may also concentrate the liquor in the vacuum pans 31 prior to discharging it into the furnace. Upon injection into the furnace the black liquor is further concentrated by the hot products of combustion of the burning fuel, and upon passing farther down into the heated zone of the furnace the organic material in the black liquor is ignited.

The chemical reagents in contact with the ignited organic matter become further concentrated and finally heated to the point of fusion. Upon passing farther down into the furnace they enter a reducing zone which is maintained adjacent to the grate 28, by suitable regulation of the fuel, air and discharge of the liquor. Here the reduction of the chemical compounds present is substantially effected and the fused reagents are substantially deposited on the grate 28, together with the ash from the fuel and organic matter, finally dropping through into the ash pit 32. At frequent intervals the fused reagents and ashes are removed from the ash pit 32 through the tap 33 and the chemical reagents leached out with water in the washing tanks 34. The solution is then placed in suitable storage facilities or returned directly to the impregnating tank 12.

The waste products of combustion pass out of the combustion chamber 26 through the vent 36. They may be used for heating purposes or vented directly to the atmosphere through a stack.

Some of the sodium salts and sulphur compounds are volatilized during the concentration and pass off with the products of combustion of the burning fuel and the ignited organic matter. To recover these and to accomplish other purposes a second chamber 37 is provided in communication with the furnace chamber 26 through the conduit 38. In the second chamber, water is sprayed over suitable contacting means, as the baffles 39, from the spray nozzle 41. The substantial recovery of the reagents volatilized during the heating in the first chamber is thus effected by contacting them with the water.

The water, containing the chemical compounds, dissolved in the chamber 37, is drained out of the chamber by the overflow pipe 42, into the storage tank 43, where the sulphur or sulphur sludge present separates out. The sulphur or sulphur sludge is returned to the furnace chamber where it is burned, with the wood refuse, or it may be introduced into the furnace with the black liquor discharged through the injector.

The water is passed to the stock chests 18 for use in washing the pulp. A portion of the water thus used passes on to the washer 17, while the remainder is used in leaching the reagents from the smelt discharged from the furnace.

The unabsorbed gases pass out of the chamber 26 through the passage 44 into the lower portion of the furnace chamber 26, where their presence aids in preserving the reducing zone adjacent to the grate 28. Further opportunity is thus secured for the removal of any combustibles present.

During the combustion of the organic matter contained in the black liquor, particles of the fused salts will be swept up with the products of combustion. The contact with the water sprayed into the second chamber 37 will usually remove them from the gases and effect their solution.

The strong smelling odors arising from the ignition of the organic matter in the black liquor will be substantially washed out of the gases through contact with the water sprayed into the chamber 37 from the spray nozzle over the baffles.

To collect the vaporized chemical reagents and obnoxious gases arising from the pulping process, means are provided, in the vapor line 46, for collecting the vapors as they arise during the process from the impregnating tank 12, digestor 13, disintegrator 14, screen 16, and washer 17, or these pieces of equipment may be made suitably vapor tight and the vapor collected from the vapor spaces of the several pieces of equipment by a line similar to the vapor line 46. Suitable regulating and safety devices are provided together with blower equipment for conveying the vapors. The collected vapors are conveyed through the line 46 and introduced into the furnace chamber 26 through the port 47, adjacent to the grate 28.

The combustible portions of the vapors thus collected are ignited in the furnace while the reagents are concentrated by the heat of the furnace atmosphere and are finally substantially recovered in the smelt drawn from the furnace, or through solution in the water sprayed into the chamber 37. If it is desired, air may be mixed with the vapors before they are introduced into furnace 26 to promote combustion in the furnace.

I claim:

1. The process of recovering reagents used in a manufacturing process comprising injecting a black liquor into a furnace to concentrate the same and to burn out organic matter, scrubbing products of combustion and vaporized reagents from the furnace with a fluid to recover the reagents and to remove obnoxious gases, and separating a reagent constituent substantially insoluble in the scrubbing fluid from the fluid.

2. The process of recovering reagents used in a manufacturing process comprising injecting a black liquor into a furnace to concentrate the same and to burn out organic matter, scrubbing products of combustion and vaporized reagents with a fluid to recover the reagents and to remove obnoxious gases, and separating a reagent constituent substantially insoluble in the scrubbing fluid from the fluid and returning the separated reagent constituent to the furnace.

In testimony whereof, I have hereunto set my hand.

JOHN H. SPOHN, JR.