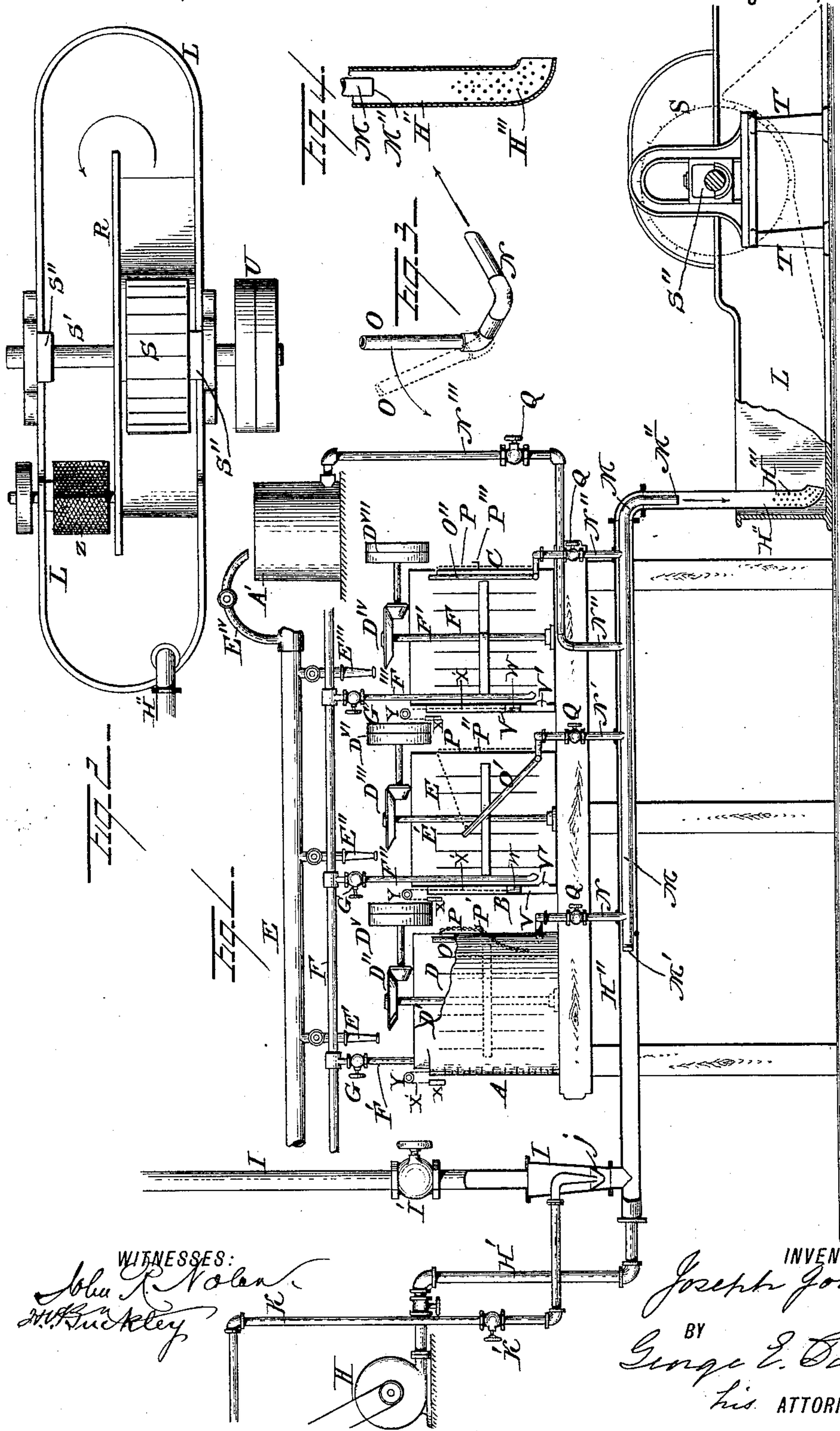


(No Model.)

J. JORDAN.  
APPARATUS FOR BLEACHING PAPER PULP.

No. 452,074.

Patented May 12, 1891.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR BLEACHING PAPER-PULP.

SPECIFICATION forming part of Letters Patent No. 452,074, dated May 12, 1891.

Application filed May 7, 1890. Serial No. 350,894. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH JORDAN, a citizen of the United States, and a resident of Bridgeport, Montgomery county, Pennsylvania, have invented certain new and useful Improvements in Apparatus for Bleaching Paper-Pulp, of which the following is a description, reference being had to the annexed drawings, making part hereof.

My invention relates to the bleaching of paper-pulp preparatory to converting the same into paper.

The nature of my invention will appear from the following description and claims.

In the drawings, Figure 1 is a longitudinal sectional view, partly in elevation, of my apparatus; Fig. 2, a detached plan view representing a pulp-engine, sufficient of it being shown to indicate its character; Fig. 3, a detached broken perspective view of a swivel tube or pipe to carry off the contents of a mixing-tub; Fig. 4, a broken longitudinal sectional view of the perforated pipe for discharging the bleaching-liquor and steam into the lower part of the pulp-engine tank.

A, B, C, and A' are open mixing tanks or reservoirs. D E F are stirrers or agitators in three of said tanks set on upright shafts D', E', and F', which latter are operated by beveled cog-wheels D', D'', and D''', and pulleys D<sup>IV</sup>, D<sup>VI</sup>, and D<sup>VII</sup>. I have not shown the supports for these cog-wheels and pulleys because they are devices commonly used by and well-known to all skilled mechanics, simply consisting of stanchions, hangers, steady-bearings, &c.

E is an ordinary water-pipe provided with nozzles and cocks E', E'', E''', and E<sup>IV</sup>, one nozzle over each reservoir, so as to discharge into it.

F is a steam-pipe provided with branches F' F'' F''', and valves G G G, as shown. These branch pipes F' F'' F''' discharge into the lower parts of these reservoirs, so as to heat their contents from below.

H is a fan or blower to create a current of air through pipes H' and H''.

I is an air-tube provided with a valve I' and an inverted funnel or hollow cone j, the latter being open above and below.

K is a steam-pipe from a steam boiler or superheater and provided with valve K'.

This pipe passes into air-tube I near its lower end and into funnel j, into which it discharges. The exit-mouth of this steam-pipe is contracted and projects downward slightly within the funnel, whereby the jet of steam will carry the air from pipe I with it through the contracted end of the funnel j and force it into the tube or pipe H''. The end of the steam-pipe and the funnel j act as an injector to draw the air downward. The steam thus also heats the air in pipe H''. After this union of the steam and air the pipe H'' becomes a combined air and steam tube, and it is carried forward and terminates in the lower part of the tank L of the pulp-engine. This tube is perforated at and near its terminal end, as shown at H'''.

M is a liquor-pipe set inside of tube H'', and is of such a diameter as to leave an annular space between it and the inner walls of said tube. This pipe is closed at its end M' and open at the other end M'' within the tube H''. Short pipes N N' N'' N''' connect the interior of pipe M with the interiors of the respective tanks A B C' and A', through the sides of which these short tubes project. The ends of these short pipes are provided, respectively, with short swivel terminal pipes O O' O''. These swivel-pipes are open above and are held upright or in the desired position by chains P P P and hooks P' P'' P'''. These pipes are held out of the line of the sweep of the stirrers when the latter are in operation, and when the stirrers are stopped and the liquor settles the chains P P P are loosened and the pipes allowed to lean sufficiently forward to dip their upper ends beneath the surface of the contained liquor. As the liquor passes out, these pipes are lowered still farther until the desired quantity of liquor is drained off, when they are drawn back and fastened by the chains.

Q Q Q are valves.

I have shown only those parts of the pulp-engine as are necessary to indicate the character of the machine, as I claim nothing new in its structure, and any open tank which will contain the mass of pulp to be bleached and keep it in a state of agitation will answer my purpose.

L is the tank of the pulp-engine.

R is a middle partition, called a "mid-



feather," leaving a space all around between its ends and sides and the sides and ends of tank L, for the pulp to traverse in its treatment.

5 S is a cylinder armed transversely with knives and set on shaft S', which latter is mounted in bearings S'' S'', which are supported by standards T T.

U represents fast and loose pulleys to operate the shaft.

Z indicates the ordinary washer of a pulp-engine.

The stirrer D is in one plane, whereby when stopped it can be placed in such a position as to leave a space unobstructed by machinery opposite to the swivel-pipe, so as to permit the latter to incline forward across the tank, if necessary. This swivel end is attached to pipe N near the bottom of tank A and is of a length sufficient when let down to a horizontal position nearly to touch the opposite inner face of the tank A. The other stirrers and swivel-pipes are similarly arranged and constructed.

25 V is a vertical tube or chamber on the outside of each tank A B C, having an opening or openings V' near its bottom into the interior of the tank, whereby the height of liquor in the chamber V will coincide with the height of the liquor in the tank.

W is a float in chamber V, and X an elongated outside weight connected with the float W by a chain X', which passes over a pulley Y.

35 On the outside of the chamber V is a vertical indicator, as shown, and the height of the weight X shows on this indicator the height of water in the chamber V and in the tank.

The tanks A, B, and C are similarly provided with the last-described apparatus.

By the old method of bleaching pulp the latter is heated up in the engine to a high degree to expedite the process by expanding the pulp and driving the chlorine gas out of the water, in which it is in solution. Chlorine gas is lighter than the atmosphere at from about 60° to 70° Fahrenheit, and the gas in solution is by the old methods applied to the surface of the pulp, while the latter is being heated up. It is applied to the surface of the pulp, the temperature of which is so high as to drive off the larger portion of the chlorine-gas into the atmosphere, the pulp only receiving a portion of it. The same will occur where alums or acids are used as disengagers of the chlorine on surface application. This results in great loss and expense, lessens the effect of the application of the chlorine, and the escaping gas, being inhaled by the operatives, renders the latter unhealthy and sometimes drives them away. It is my object to avoid these disadvantages, and the operation of my apparatus is as follows: I first place the pulp to be bleached in the tank L of the pulp-engine, the pulp being mixed with water to the usual consistency for agitation and so as to flow. I then turn on the steam through pipe

K and as much air as I desire through pipe I. The blower-pipe H' is kept closed. The air unites with and is heated by the steam and surrounds and heats pipe M in their joint passage to the pulp-engine. Tank A contains chloride of lime in solution in water, which is commonly called "bleach-liquor." Tank B contains a solution of, say, bicarbonate of soda. Tank C contains a solution of either alum, sulphate of alumina, or acid sodium sulphate—that is, any one of these solutions may be used, or any two or more of them, in tank C to cleanse the pulp and to remove from the latter all foreign matters which would resist the subsequent action of the bleaching agent. The solutions in the various tanks having been diluted by water from nozzles E' E'' E''' E<sup>IV</sup> to the required strengths the pulleys D<sup>V</sup>, D<sup>VI</sup>, and D<sup>VII</sup> are started by belting and the stirrers D E F are thus put in operation until the contents of the respective tanks are thoroughly mixed and the solid matters dissolved. The stirrers are then stopped by throwing each belt onto a loose pulley. Tank A' being charged with a solution of oxalic acid requires no stirrer. Time is then allowed for the superfluous matter or dregs to precipitate. The liquors are then ready for use. Pulley U is then started and the pulp-engine put in operation thereby. The pulp then begins to travel around the tank L in the direction of the arrow in Fig. 2. The steam and air having been admitted to tube H'', as above described, the cleansing-liquor from tank C is then permitted to flow through pipe N'' to interior pipe M, pipes N and N' being kept closed. This cleansing-liquor is highly heated by the hot combined steam and air surrounding pipe M, and passes into the interior of tube H'', where it unites with the steam and air, and the combined hot steam, air, and cleansing-liquor enter the lower part of the mass of moving pulp through the open end of tube H'' and are thoroughly intermixed with it by revolving cylinder S. The steam and hot air heat the mass of pulp, and when the latter is sufficiently heated the steam and air are closed off and the cleansing agent alone is used. The combined water and cleansing agent are then washed out by the washer Z, which latter is well known in the art and requires no special description here. It is a revolving hollow cylinder covered with wire-cloth, through the meshes of which the liquids pass (excluding the pulp) and are carried off to the exterior of the tank L through the hollow cylinder-shaft. This operation is continued until the mass is thoroughly cleansed. All the time the washer is removing the liquids fresh water is being admitted into tank L, thus leaving the mass of pulp of the same consistency as it was in before the washing. The pipe N'' is now closed by the valve Q. The pulp is now in a condition known among paper manufacturers as "semi-white," which answers for many grades of paper. The chemical cleansing agent is



sometimes omitted—viz., in cases where the pulp can be sufficiently cleansed by merely washing it with a continued injection of clear water to take the place of that removed by the washer, or where it has been washed before. In the case of pulps produced by the caustic-soda process the simple washing in the water only is frequently sufficient without requiring the use of the chemical cleansing agent. The judgment of one skilled in the art must in these cases be his guide. In order to produce a pulp of whiter tint, I open the steam-pipe H' and air-pipe I again, thus filling tube H'' with heated combined air and steam and heating interior pipe M. I now open pipe N' to permit the solution of bicarbonate of soda to flow from tank B into pipe M, where it is highly heated and unites with the hot steam and air at the exit of pipe M, and the combined carbonate and steam and air pass through tube H'' near to the bottom of the mass of pulp in tank L, where the combined fluids, steam, air, and solution enter the mass of pulp. The bicarbonate of soda acts as a "disengager" for the chlorine when the latter is subsequently introduced and permits its free action upon the pulp. When sufficient of bicarbonate of soda is introduced, its flow is stopped by closing pipe N', and the pipe N from the chlorine-tank A is opened, thus permitting the chlorine solution to flow into the closed heating-pipe M, where it is highly heated and passes to the exit M'' of pipe M, where it unites with the hot steam and air and passing through tube H'' enters the moving mass of pulp near the bottom of tank L. The highly-heated air and steam disengage the chlorine, and in a highly-rarefied condition it enters into and permeates the whole mass of pulp, thoroughly impregnating it and acting on every particle of pulp and being absorbed by the latter. This method of introducing the chlorine into the pulp insures great expedition and effectiveness in its operation. The heating of the chlorine up to a high degree is not possible without great loss, unless it is done, as I have described, in an inclosed space, as in pipe M. In this pipe it can be heated up to 180° Fahrenheit and above. By the present method the solution of chlorine is poured onto the top of the pulp in the engine, the pulp being heated to from 160° to 180° Fahrenheit. This results in driving off about twenty-five per cent of the chlorine gas into the surrounding atmosphere and the availability of the chlorine is diminished to that extent. The chlorine will be liberated from its solution at a temperature of from 60° to 70° Fahrenheit where exposed to the atmosphere. By my method the chlorine solution is highly heated in an inclosed pipe or tube and where it is not exposed to the atmosphere. In my apparatus the chlorine at a high temperature enters the mass of pulp, which is at a low temperature. Consequently the chlorine will seek it and be absorbed by the

moving mass as it (the chlorine) leaves the exit of tube H''. The operation continues until the mass of moving pulp has been sufficiently charged with the chlorine. I now close off the chlorine-pipe N. I then open pipe N''' to permit the flow of the solution of oxalic acid from tank A'. This solution is heated in pipe M, as described above of the other solutions. It enters the body of the pulp at the same point as the chlorine does and permeates the mass. This acid neutralizes any oxides of iron which may be in the pulp, and further assists the chlorine to set or strike the color. The oxalic acid also more thoroughly disengages the chlorine. After the desired white shade of pulp has been reached the steam-pipe K, air-pipe I, pipe N''', and all other pipes are closed, and the air-fan on blower H is started and blows cold air into the mass of heated pulp at the exit end of tube H'', which cold air enters the mass of moving pulp and rapidly cools and aerates it.

In tank C my solution is of a strength of about two pounds of acid sodium sulphate or of sulphate of alumina, or both combined, to one hundred pounds of pulp, (dry weight.) To this quantity of pulp I use about ten pounds of bleaching-powder in solution. Of the oxalic acid I use about four ounces in solution to about that quantity of pulp. In order to hasten the action of the chlorine or bleaching-liquor, I add a small quantity of acid sodium carbonate in solution.

Yarns and textile fibers of cotton, hemp, jute, and other vegetable fibers may be bleached in my apparatus. The tube H'' may be called a "jacket." The inner pipe M may terminate with its open end at any point of the tube H'' which will insure the thorough union in tube H'' of the steam and of the liquor from the liquor-tank before reaching the pulp.

What I claim is—

1. In apparatus for bleaching paper-pulp, the combination, with pulp-tank L, of liquor-tank A, with its outlet-pipe N, tube or jacket H'', and the liquor-pipe M inclosed thereby, leaving an annular space between the jacket H'' and said pipe M, pipe N piercing jacket H'' and opening into said inclosed interior pipe M, steam-pipe K, adapted to convey steam to the interior of tube or jacket H'' to surround and heat pipe M, the latter being closed at its inner end M', and both pipe M and tube or jacket H'' being open at their outer ends, said outer end of tube H'' being carried to or near to the bottom of tank L, whereby the liquor in pipe M will unite with the steam at or near the outer end of tube H'' before reaching the pulp and together enter the lower part of the mass of pulp to be bleached in tank L, substantially as described.

2. In apparatus for bleaching paper-pulp, the combination of tank A, tube H'', provided with steam-pipe K and air-pipe I, connected

with the interior of tube H'', whereby the air  
is combined with the steam and is heated  
thereby, pipes or tubes adapted to carry li-  
quor from tank A to the interior of tube H'',  
5 and pulp-tank L, in the lower part of which  
tube H'' terminates, its end being open,  
whereby the liquor and the combined heated  
air and steam will unite with each other and

enter the lower part of the mass of pulp to-  
gether, thus heating and otherwise acting 10  
upon it simultaneously, substantially as de-  
scribed.

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Witnesses:

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