The invention relates to a process for bleaching and like purposes, as described in the present specification and illustrated in the accompanying drawings that form part of the same.

The objects of the invention are to efficiently convey the bleaching agent throughout the mass, so that the distribution thereof shall be even and the mass perfectly penetrated, especially in the case of pulp of comparatively high density, where the difficulty has been the overbleaching of some fibres and the underbleaching of other fibres will change the chemical constituency and the physical properties of the pulp; to reduce as far as possible the use of mechanical screw conveyers customarily used for effecting the penetration as such methods materially damage the fibrous nature of the pulp through its contact with the metal of the propellers; to drive out the accumulation of decomposition gases incidental to all bleaching operations; to bring forth as a result of this method a product of a superior grade and applicable for the manufactures in a more embracing way than is usual in pulp products; to produce a pulp of higher physical strength, of greater purity chemically, of better color and greater and superior in its cellulose properties; and generally to devise a method of bleaching that will insure economy in regard to the consumption of the agent employed and effect the production with reasonable despatch and certainty of a resultant of superior quality capable of gaining high standards in the manufacturing arts.

Hereto the importance of a uniform mixing of the three ingredients pulp, water and bleaching agent has not been realized. To get the very best results in bleaching this has to be done and to accomplish this thoroughly it is necessary to open up the fiber bundles and separate the fibers and bring each one into contact with the water and bleaching agent and allow each fiber to fully absorb the bleaching agent because if one fiber absorb the bleaching agent fully and another fiber partly an even or uniform product cannot be expected.

The invention consists essentially of the various steps and modifications thereof taken in or about the order set forth in detail hereinafter and pointed out in the claims for novelty following the explanation of the invention.

The drawings diagrammatically illustrate the several steps taken necessary to complete the process and in Figure 1 the simple process is shown wherein the essentials to its completion are included, in Figure 2 the compounding of the process is shown by the addition of elements whereby the process is carried out in stages and in Figure 3 the illustration points out a modification of the aerating method.

In the three figures some of the parts are common to all forms of the invention and are indicated by the same numerals throughout.

In the first place it is required to draw the bleaching liquor and hot water coincidentally and this is preferably done from a bleaching liquor head box 5 through a measuring box 6 and piping 7 and from a hot water head box 8 a measuring box 9 and piping 10.

Two of these feeds contribute to the first step in the process, which is carried out in the mixer 11 having the pulp inlet 12 and adjacent inlets for said hot water and bleaching liquor from the pipes 7 and 10. The pulp fed into the mixer 11 is preferably quite dense; as better results are obtained by operating a dense mass.

The inlet 12 is at one end of the mixer 11 on the upper side and the outlet 13 at the other end on the lower side and the casing increases in size towards the said outlet.

Inside the mixer 11 the paddles or sticks 14 projecting from the shaft 15 in staggered arrangement stir and tear the pulp mass and separate the fibers and hot water and bleaching liquor and this stirring keeps the pulp in motion, so that naturally it moves constantly towards the larger end of the mixture and discharges itself through the outlet 13 leading to the tank 16, which is also tapered from the lower end having the discharge opening 17 leading to the washer and thickener chamber 18. The mixture is of high density which as considered in the art
is a mixture containing at least approximately 17% of pulp which is approximately the correct density for this particular process though it may vary several degrees according to the destiny of the finished pulp in regard to the ultimate product therefrom and further it may be explained that the approximate percentage mentioned is intended to point out the condition of the pulp during bleaching previous to washing and thickening.

The pulp, which has the bleaching liquor fairly well distributed throughout during the stirring by the sticks 14 rotated with the driven shaft 15, flows into the tank 16 continuously and is presumed to maintain this tank 16 fairly well filled up and a proper level of the mass and a uniform pressure of the same are maintained by the arm 19. The hollow shaft 20 forms the air passage for the aerating of the mass and extends centrally and vertically through the tank 18 and is connected through a coupler 21 to the stationary air pipe 22 leading from the compressed air tank 23 fed from the air compressor 24.

The levelling arm 19 is mounted on the shaft 20, which is driven by the gears 25 and 26.

The nozzle 27 is also mounted on the shaft 20, and communicates therewith to discharge air through the perforations 28 into the pulp mass through which the shaft 20 extends.

The nozzle 27 is in the lower portion of the tank 16 but considerably above the bottom and rotates with said shaft, so that the aerating step in the process, which is always an essential, is continuously maintained, that is to say, that so long as the pulp is passing through the tank 16 the air is circulating throughout the mass and driving out the decomposition gases.

The pulp is of course in constant movement, but it is slow enough to permit the efficient operation of the bleaching agent and its ally compressed air and as the mass reaches the chute of the discharge opening 17 it passes out assisted by the high pressure water spray from the passage 29.

The pulp is kept in movement at the lower end on the hopper bottom 30 of the casing 16 by the scraper arm 31, which is curved and reaches out from the shaft 20 to the inner wall surface of the casing 16 and maintains the movement of the pulp to the opening 17 to effect a continuous discharge.

It is not desirable to end the process at the first tank, so after the pulp has passed through a combined washer and thickener 32 it passes into a mixer 33 precisely the same as the mixer 11 and having similar hot water and bleaching liquor feed connections to insure the continuation of the process on entirely similar lines with the bleaching liquor fed into a mixer in the presence of heat in the hot water previous to its introduction in the bleaching vat or tank.

The tank 24 is connected to the mixer 33 and discharges the pulp carried into the washer and thickener 35 and from there into the mixer 33 and on to the tank 27, which discharges to thickeners and stock chest.

The interiors of these mixers and tanks are all similar to that already described and by having them the process is carried out in stages and this much improves the result and assures a better product.

The tanks are preferably round and the process carried out as described, but square tanks, towers or vats may be used and this form is illustrated in Figure 3, where the air feed pipe is connected to a distributing pipe 38 from which the pipes 39 extend downwardly into the tank 40, and these pipes being perforated as shown at 41 each form nozzles for the lateral distribution of air throughout the pulp or other mass in the tank. The pulp or other mass coming from the mixer is aerated in the square tank and assisted along the chute 42, sprayed from behind from the water nozzle 43 by the revolving floor grate members 44 and eventually discharged into the combined washer and thickener 45, which communicates with the mixer 46 in turn connected to a similar tank 47 and continued as often as it is thought advisable to repeat the process in its various stages.

It is quite possible to carry out the process complete, in the single aerating tank, but it would necessarily be done by intervals as the continuity in treatment for a length of time develops decomposition products harmful to the pulp besides for a good output the bleaching by stages is very efficient indeed.

It is not an essential to finish the process by following this invention throughout, as the later stages could be carried out with various forms of apparatus well known in the art.

It may be mentioned that there are machines that meet with moderate success in the handling of dense pulp, but the product is not all that it should be for metal propulsion members are used and these cause damage to the fibre and in circulating the mass much of it is inactive which retards the process and necessitates considerable more force than is desirable in keeping the pulp moving.

In the present invention the pulp progresses naturally from one state to another and preferably by stages and never has an idle moment until it reaches the stock chest.

It must be understood that this process, while primarily conceived and brought to a practical stage for the purpose of efficiently bleaching pulp for paper making, silk and other manufactures may be turned to other uses, especially in cases where penetration and distributions are essential throughout the body of the substance to bring forth a
good result in the product, consequently the air may be replaced by various gases or even liquid if desirable or both in the event of such being found practical.

In the several mixers where the process is carried out in several stages the same method is used in regard to the feeding of the bleaching liquor and hot water as pipes for the purpose are extended to each of the mixers leading to an aerating tank. What I claim is—

1. The herein described bleaching process comprising separating the fibers and introducing the bleaching agent with water to the material to be bleached, for impregnating said fibers and discharging the mixture into the bleaching receptacle and maintaining non-turbulence in the accumulation undergoing bleaching notwithstanding its constant discharge during operations.

2. The herein described process of bleaching pulp comprising a primary agitation of the pulp and bleaching agent together in the presence of heat, discharging the resultant product and accumulating it in a sluggish mass relieved by a constant discharge and feeding compressed air throughout the accumulation during its travel to its discharge.

3. The herein described process of bleaching pulp comprising stirring the pulp with a bleaching agent and hot water, passing it by gravity to an accumulation of the pulp and bleaching agent and rotating jets delivering streams of compressed air through the accumulation.

4. The herein described bleaching process consisting in directing a mass of material to fall by gravity, and form a continuously changing non-turbulent column and bleaching the material during its movement.

5. The herein described bleaching process consisting in moving by gravity a mass of material, subjecting it during such movement to the action of a bleaching agent and simultaneously subjecting the material to the action of air moving in a direction opposite to that of the material.

6. The herein described bleaching process consisting in continuously advancing by gravity and feeding with a bleaching agent pulp material of high density, and maintaining said material in a quiet state and in continuous forward movement during two stages of bleaching and feeding.

7. In a process of the character described, feeding the pulp into a container from the one side and forming a column continuously falling and discharging at the same rate as the feed and simultaneously projecting in an upward direction air through the pulp and distributing the pulp fed into one side of the container to insure a uniform level and depth to the air delivery.

9. The herein described bleaching process consisting in mixing material and bleaching agent to produce a mixture of high density, aerating the mixture, washing out the salts resulting from the bleaching reaction, removing excess water and adding water and bleaching agent to restore the density and strength of the mixture, and repeating the operation.

10. The herein described process of bleaching consisting in first bringing the pulp and bleaching agent to a high density to retard its passage whilst continuously falling, then directing it by way of a stream passing in a continuous line of contracted and widened areas and coincidently directing streams of air in a contrary direction to the movement of the pulp for the removal of the decomposition gases.

11. The herein described process of bleaching consisting in feeding the bleaching agent and warm water to a continuously passing stream of high density pulp adapted to fall sluggishly, to an enlarged bleaching area and therein expelling the gases as formed in a direction at variance with the movement of the pulp, then directing a stream of water behind the outgoing pulp and reducing the density and removing bleaching agent and finally thickening.

13. In a process of the character described, separating the fibers of pulp during its continuous movement through a fixed enclosed passage and coincidently feeding water and bleaching agent into the separated fibers and impregnating the latter with said bleaching agent by so uncovering the pores and at the same time fixing the density and transferring the prepared mixture to a bleaching enclosure.

15. The herein described process of bleaching, a gravity system of progressing the pulp from the feed to the stock chest, including the accumulation in non turbulent masses at intervals in the fall and the introduction of agitation before and between accumulations for mixing the bleaching agent with the pulp accompanied by washing and thickening in the intermediate mixing and at the end.

14. In a process of the character described, the creation of a stream of pulp in turbulent and non-turbulent stretches and a gaseous agent in the non-turbulent stretches in a contrary direction to the fall of the material.

15. The herein described process of bleach-
ing pulp consisting in agitating the pulp bundles and thereby separating them into fibers thus exposing their capillary nature and coincidently impregnating the fibers with a bleaching agent and water to bring the pulp to be bleached to a dense condition, feeding the mixture continuously to a vessel and therein expelling the decomposition gases in a non-turbulent mass during the period of bleaching in said vessel and continuously withdrawing the bleached pulp.

Signed at Montreal, Canada this 19th day of November 1924.

CARL BUSCH THORNE.