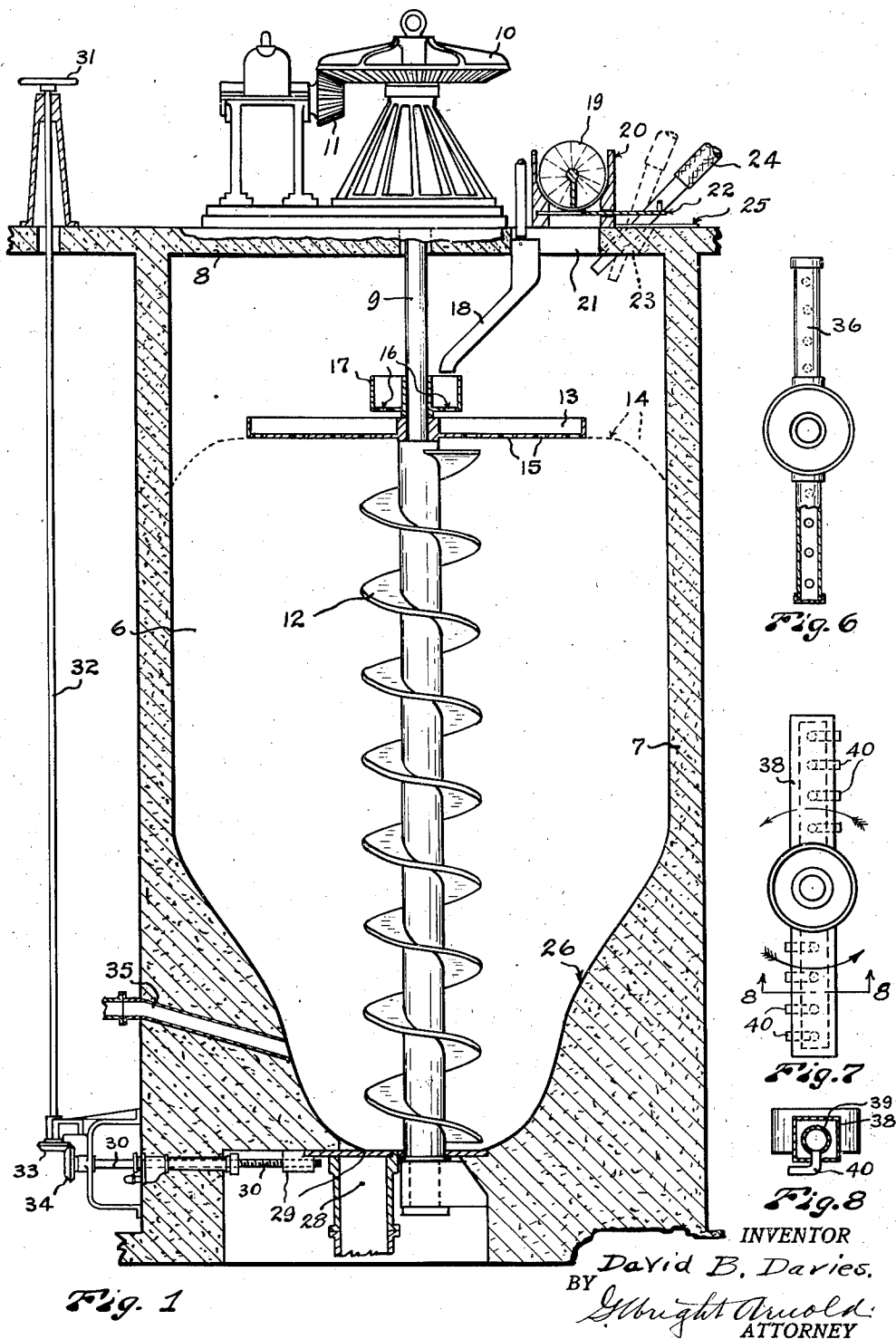


Aug. 7, 1934.

D. B. DAVIES
PROCESS OF BLEACHING WOOD PULPS AND AN APPARATUS
FOR CARRYING OUT SAID PROCESS
Filed April 8, 1931

1,968,994

2 Sheets-Sheet 1



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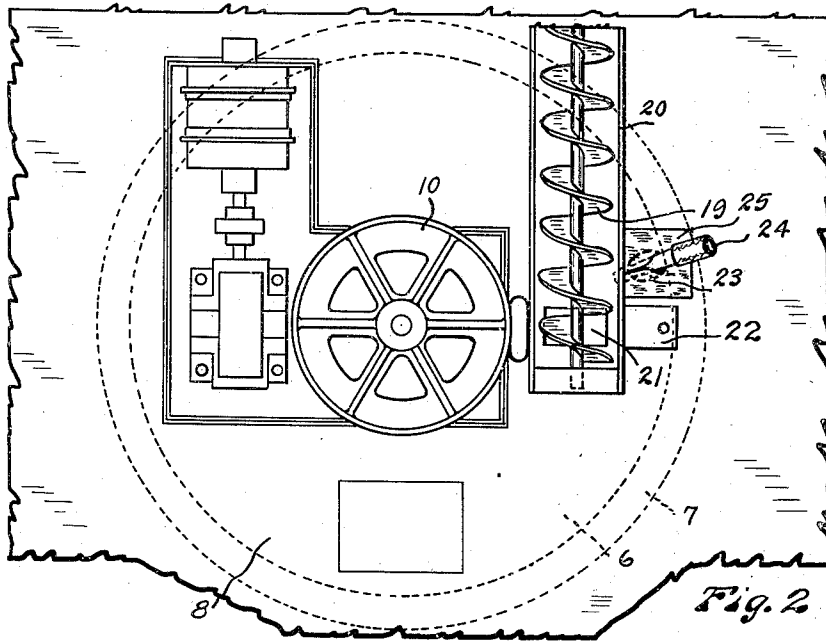


Fig. 2

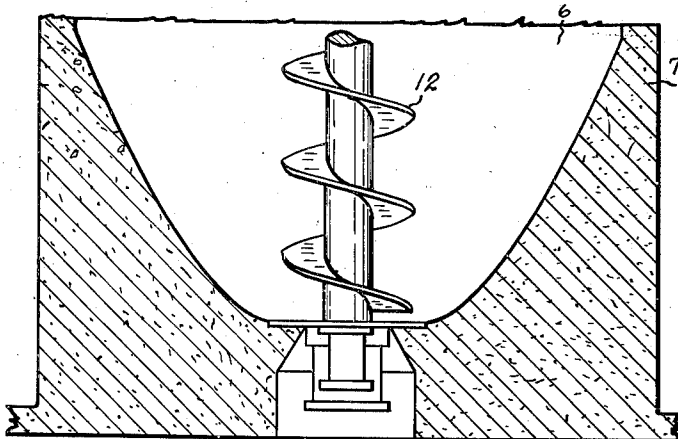


Fig. 3

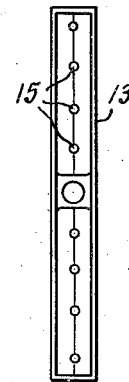


Fig. 5

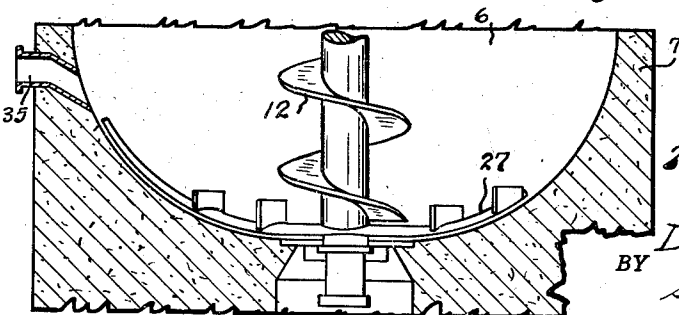


Fig. 4

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PROCESS OF BLEACHING WOOD PULPS AND
AN APPARATUS FOR CARRYING OUT
SAID PROCESS

David B. Davies, Shelton, Wash.

Application April 8, 1931, Serial No. 528,514

2 Claims. (Cl. 8-2)

My invention relates to the process of bleaching wood pulps and to an apparatus for carrying out said process. More particularly, my invention relates to a process characterized in having a circulation of pulp whereby one part of the pulp moves in an upward direction with respect to the remainder of the pulp without confining said parts to separate chambers; and to an apparatus or bleacher cell having (a) levelling-arms functioning to determine when the desired charge of material is supplied to the apparatus and to circulate the material, said arms preferably having means to conduct bleaching solution and sprinkle the same uniformly over the top of the charge of material; (b) means to direct water against the conveyor member of the apparatus to remove material from said member; and (c) being without chamber forming casing or housing.

The bleaching process of, and the apparatus for bleaching of, wood pulp presents a complex problem, and any successful process or successful apparatus for carrying out the process must be characterized by being capable of variation to meet the varying character of the pulp, which in turn is varied according to the purpose for which the pulp is to be used. The "bleaching" action, it will be understood, involves, particularly in the initial stages, purification of the wood pulp and is not confined to changing the color to white.

Wood pulp has the property of acting as a blotter and readily absorbs liquid to which it may be exposed, or with which it may come in contact. Therefore, the process and apparatus must be such as to thoroughly expose every portion of the wood pulp to direct contact with the bleaching solution introduced. This in turn means that the circulation of the wood pulp must be most thorough—no "dead pockets" must be permitted. It will be understood that any portion that is not bleached may operate to discolor the portion which is bleached upon the charge being removed from the bleacher. Bleaching being in part a purification process, uniformity of action helps form alpha, beta and gamma cellulose in proper proportions, all of which seem to be desirably present and determine the properties of the final product, whether in the form of paper or rayon.

Wood pulp is further characterized by the property of being readily discolored by the presence of foreign material, and particularly is this true of iron, either in the form of small metallic particles which may break loose from

parts of the apparatus constructed of iron after corrosion due to the action of the chemicals employed in treating the pulp, or to the iron which may be dissolved by reason of the chemical agents employed to treat the pulp acting upon parts of the apparatus constructed of iron, or to iron in colloidal form. Therefore, it is particularly advantageous, if not positively essential, to eliminate all the internal parts of the machine which are constructed of iron or other metals. Wood pulp must be free as possible of "dirt" particles or specks. In fact, pulp is graded according to the "dirt" count. The apparatus in common use constitutes an actual source of contamination.

An object of my invention is to eliminate from the bleaching apparatus all parts of metal construction as far as possible, since the iron or other metals are subject to being chemically acted upon by the bleaching, i.e., chlorine, solution, thus constituting a source of dirt of iron particle nature and iron in solution, or iron in colloidal form.

Thus iron or other metal parts of the apparatus constitute a source of metallic particles and iron in solution or colloidal form, all of which operate in the final process to discolor and otherwise degrade the pulp. The particles of iron or other metals may not at first discolor the pulp, but such particles, when the particular pulp is acted upon by chemicals employed to produce rayon, may discolor the rayon. That is, the iron particles in subsequent treatment may become highly objectionable in the form of dissolved iron. Heretofore the common standard practice bleacher generally employed embodies a screw conveyor which operates in an axially disposed chamber formed by a metallic casing surrounding said screw conveyor. Heretofore it has always been deemed necessary to thus provide two chambers within the bleacher, the inner one in which the screw conveyor is disposed, and the outer, annular chamber. In this structure commonly employed and in general use, the material in the inner chamber is thus positively separated from the material in the outer surrounding chamber.

A primary object of my invention is to provide an apparatus or bleacher cell which does not have this axially disposed casing; and it is similarly my object to provide a process characterized by its thorough circulation of wood pulp wherein that part of the pulp in the inner or axial region is moving upwardly by aid of

the conveyor, and that part in the peripheral section is moving downwardly while the parts of said oppositely directed moving parts of pulp are in direct intimate contact with each other.

5 A further problem in providing a bleacher is to provide one in which no part of the pulp can be subjected to a rebleaching process after said pulp has been once fully bleached.

Serious objection obtains to the common practice form of bleacher having the casing forming an inner chamber because at the conclusion of the bleaching process there remains in the axially disposed chamber a relative large proportion of the charge, which is fully bleached,

10 said portion in said chamber amounting to as much as one hundred cubic feet. It is very difficult to remove this portion of the charge within the axially disposed chamber and ordinarily this portion is allowed to remain and become re-

15 bleached with the next charge. To enable the conveyor to lift the material in the inner chamber requires the pressure of constantly newly fed material at the bottom and the consistency of the pulp is such that running the conveyor

20 backwards fails to eliminate it. The rebleaching forms undesirable compounds which seriously affect, by direct action or by acting catalytically, the value of the charge. An object of my invention is to eliminate this difficulty and provide

25 a bleaching apparatus from which the entire charge may be removed and no portion subjected to being rebleached. Again, owing to the high absorption property of wood pulp, it is important that the bleaching solution should

30 be put into direct contact with every part of the pulp. Pulp should not be bleached indirectly, that is, it should not only receive its bleaching solution through contact with other pulp containing the bleaching solution, but rather,

35 so far as possible, every part should itself be brought into direct contact with the bleaching solution. There should be no spotty high bleach solution concentration sections in the charge but the solution should be evenly distributed

40 throughout. It is the object of my invention to distribute the bleaching solution to every portion of the charge, and to this end special means are provided for distributing, immediately upon its introduction, uniformly the bleaching solution

45 over the top of the wood pulp, that is, over the ascending as well as the descending column of pulp. The introduction of the solution according to my invention is such that it can be done

50 even while the pulp is being introduced. A further object of my invention is to provide uniformity in volume of charges to the bleaching apparatus. The importance of this is thus explained. It is very important to know and regulate the exact relationship between the bleaching

55 solution and the quantity of pulp. In doing this the first step is to know the consistency or density of the pulp, that is, the percentage of water present. The next fact that must be determined is the volume of the pulp present, that is, the charge volume. Thus, it is important to know when you have a full charge so that this charge volume factor is relatively constant.

60 Pulp, due to its varying character, forms a cone with bleacher cell of varying angles; therefore, it is important to have some means of knowing when the cell is fully charged as respects volume. The percentage of water is separately determined. Thereupon, with these facts ascertained

65 the percentage of bleaching solution to be added

is correlated. For this purpose it will be understood that while the cell is being charged a portion, as a sample, of the material is removed while en route to the cell and placed in a centrifuge machine; then the centrifuge delivers a sample of a definitely known moisture content. To know precisely the volume of the pulp present in the charge is important, then in order to utilize the proportions revealed by treatment of the sample, and to know the charge volume present, all fluctuations incident to varying cones must be eliminated.

It will be understood that the character of the pulp supplied to the cell varies and this variation is intentional and is determined by the particular purposes for which the pulp is to be used. This means varying quantities of the bleaching solution must be applied.

70 Having the water content determined by testing said sample, a well known permanganate of potash test is next applied to determine what is known in the trade as the "bleachability" of the pulp.

75 Having thus determined the bleachability and the volume of the standard charge, it is then known what quantity of the bleaching solution is required to get the degree of the bleach desired for the particular product for which the particular charge is to be used. Thus, uniformity in volume of charges is a fundamental requirement to get a basis for measurement of the solution to be added.

The above mentioned general objects of my invention, together with others inherent in the same, are attained by the process, illustrated in the following drawings, the same being preferred exemplary forms of embodiment of my invention, throughout which drawings like reference numerals indicate like parts:

80 Figure 1 is a view in vertical, longitudinal section of a bleaching apparatus embodying one form of my invention;

85 Fig. 2 is a view of the top of the device embodying my invention;

90 Fig. 3 is a view in section of a modified form of the bottom portion of the same;

95 Fig. 4 is a view of a further modified form of the bottom portion of same with plow;

100 Fig. 5 is a plan view of the levelling-arms;

105 Fig. 6 is a view of levelling-arms of modified form, i.e., pipe construction;

110 Fig. 7 is a view of levelling-arms of modified form, i.e., boxlike construction; and

115 Fig. 8 is a view in section on line 8-8 of Fig. 7.

The bleacher or bleacher cell, ordinarily running to twelve feet in diameter and fourteen to eighteen feet high, is formed with a vertically disposed chamber 6 having walls 7 of suitable material, preferably concrete and tile lined, and a covering 8 for the top. A shaft 9 is mounted in the chamber 6 having actuating gears 10 and 11 operatively connected to a source of power. A screw or conveyor flight 12 is keyed upon the shaft 9 so as to turn with said shaft and terminates at about the height or level to which the charge is desired to fill the chamber.

120 Radially disposed levelling-arms 13, which may be of suitable construction as V-shaped (cross-sectionally considered) trough-like members, or may be of pipe construction or box-like in cross-section with solution conducting pipe therein, are keyed to the shaft 9 so as to turn therewith and cause the pulp material, which is of a consistency which forms or stands as a cone

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upon being fed into the chamber, to lie substantially flat across most of the top of the chamber at the charging level 14, indicated by the dotted line. These arms 13 preferably have perforations 15 from which the bleaching solution may be uniformly spread over the charge of pulp, including the period of charging the cell. These arms 13 are supplied by bleaching solution running down through perforations 16 in an annular receptacle 17 mounted on arms 13. A conduit 18 conveys the bleaching solution to the receptacle 17 and is in turn itself connected to a suitable source of supply of said solution.

A conveyor screw 19 in a trough supplies the pulp material to the chamber 6, through trough opening 21, which may be closed by slide 22. Conduit 18 is led in through opening 21. An opening 23 in the covering 8 may admit a nozzle 24 disposed to be turned through varying angles to permit directing a stream of wash water against all portions of the conveyor flight to remove all pulp which has been bleached in a given charge and thereby prevent rebleaching, which due to the chemical action involved is very deleterious to the product as a whole. This nozzle 24 may be secured in the opening in a flexible member 25 and adapted to be trained in varying angles, or it may have no direct connection to the cell structure but inserted only when the cell is to be discharged.

The bottom of the chamber 6 is preferably shaped so as to cause the pulp to positively flow to the section about the screw 12 where it will be acted upon by the screw and elevated. The convex curve 26 will aid and positively insure the pulp while being held down by the super-imposed part of the charge, to flow to the elevating conveyor flight 12. The bottom may have the form shown in Fig. 3. The curved forms of the bottom constitute means in the bottom of the chamber to cause the material to flow to the conveyor. Again, it may have the flatter curved bottom shown in Fig. 4, but here it will require the plow 27 to draw the pulp to the screw 12 and eliminate pockets in the material, in which pockets the material would fail to be properly circulated and not being properly circulated would fail to be properly bleached.

In the bottom, outlet port 28 is closed by sliding gate 29 operatively connected to rod 30, the turning of which causes gate 29 to move in and out. Hand wheel 31, rod 32 and gears 33 and 34 enable the gate to be operated from the top of the bleaching cell. Inlet pipe 35 for wash water permits a complete washing of the bottom of the chamber 6. The levelling means may be arms 36 (Fig. 6) of pipe construction, or they may be arms 38 (Fig. 7) of box-like construction with a pipe 39 mounted in the box-like housing in communication with the annular receptacle 17. Small branch pipes 40 bend backward from the direction of rotation, so that pulp does not fall into the arm and interfere with the flow of the solution or the small parts become clogged.

The mode of operation of much of the device has already been set forth above, and will be readily understood from the drawings. It will be noted that there is no casing about the screw or conveyor flight 12. I have discovered that the material is of such consistency that it will travel up the conveyor and be thoroughly circulated without any centrally disposed casing and hence all injurious effect of iron in particle form or in solution, or in colloid form, is obviated. This

provides a product peculiarly suited for the manufacture of paper, having a high degree of whiteness.

Such casing to form the two concentric chambers has been deemed necessary heretofore to insure proper circulation of the pulp to provide thoroughness, uniformity, and efficiency of the bleaching operation. By construction of a bleacher of standard proportions and operation in conjunction with all the remaining units of a pulp mill, I have discovered and proven that the cell does not need to have the casing to form the two chambers, and have thus provided for the elimination of the source of contamination of the pulp as herein explained. Obviously the bleaching unit must operate efficiently and in conjunction with the remaining units of the plant or it would be wholly impracticable. The levelling-arms function also to stir up the pulp and move it to the outer wall.

In treating the highly complex substance wood pulp, the character (chemically and physically) of the material presents special problems. High concentration of the bleaching solution may form deleterious compounds. Pulp, being of a fibrous character and being composed of a variety of compounds some of which are sticky, is liable to become lumpy and, but for the levelling-arms which break up, pull and push the material into other sections of the chamber in the act of spreading, it could not be readily formed into a homogenous mass with the bleaching solution distributed uniformly therethrough. The pulp is forced upwardly axially against the levelling-arms and they function to move the material promptly to the peripheral portion of the chamber and, in thus promptly removing it from the center, assist in providing efficient circulation. Moreover, not only must the mass be made finally homogeneous but, at all times during the period of treating the charge, high concentration of the solution in limited sections should be avoided and uniform distribution of the bleaching solution is accomplished in my invention from the very moment the material enters the chamber as the levelling-arms spread the solution throughout the diametrical area of the chamber. This even distribution of the bleaching solution is true even when the material is being fed into the device, i. e., even when the chamber is only partly filled. The weight of the material in the portion of the chamber peripherally disposed with respect to the conveyor flight 12 assists the conveyor to elevate the axially disposed portion of the pulp and the moving of the two portions in opposite directions and in contact with each other assists in providing thoroughness in intermixing of the pulp and the bleaching solution. Hence, the omission of the usual casing about the elevating screw is helpful in other ways than eliminating a source of contamination. Thus, in many ways the device embodying the various features of my invention is characterized by a mode of operation differing from that of the devices commonly in use.

I claim:—

1. The process of bleaching wood pulp comprising the steps of isolating a batch of said wood pulp characterized by its plastic-like and its moist but apparent liquid-free inter-locking fibrous nature; causing a circulation of said material within itself by passing a portion of said material in an upwardly directed relatively small and substantially well defined stream through a relatively greater body of the same

material moving downwardly at a relatively much slower speed than said stream moves upwardly, said stream throughout its length being in direct contact with said body of material, whereby a considerable friction between, and a rubbing and kneading action of, the contacting portions of the ascending and descending material, is developed and provided respectively; subjecting said material, while in the small stream, to a squeezing or pressing action to partially eliminate the spent or relatively inactive bleaching solution, together with some of the discoloring incrusting material; releasing said material from the said pressing and squeezing action to open the mass of fibers to permit the blotting action which characterizes said pulp to take place and reexposing the material to active bleaching solution; and then passing said exposed material to the descending body of the material to complete and repeat the circuit whereby uniformity of bleaching the wood pulp throughout is provided.

2. The process of bleaching wood pulp comprising the steps of isolating a batch of said wood pulp characterized by its plastic-like and its moist but apparent liquid-free interlocking fibrous nature; causing a circulation of said material within itself by passing a portion of said material in an upwardly directed relatively small and substantially well defined stream through a relatively greater body of the same material moving downwardly at a relatively much slower speed than said stream moves upwardly, said stream throughout its length being in direct contact with said body of material, whereby a considerable friction between, and a rubbing and kneading action of, the contacting portions of the ascending and descending material, is developed and provided respectively; subjecting said material, while in the small stream, to a squeezing or pressing action to partially eliminate the spent or relatively inactive bleaching solution, together with some of the discoloring incrusting material; releasing said material from the said pressing and squeezing action to open the mass of fibers to permit the blotting action which characterizes said pulp to take place and reexposing the material to active bleaching solution; subjecting said material after the squeezing pressure is released to a raking action to forcibly break up the somewhat matted or molded material and expose the individual fibers to the active bleaching material; and then passing said exposed material to the descending body of the material to complete and repeat the circuit, whereby uniformity of bleaching the wood pulp throughout is provided.

DAVID B. DAVIES.

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