

R. MOHR.

METHOD AND DEVICE FOR BLEACHING TEXTILE FIBERS AND FABRICS, TISSUES, AND THE LIKE.

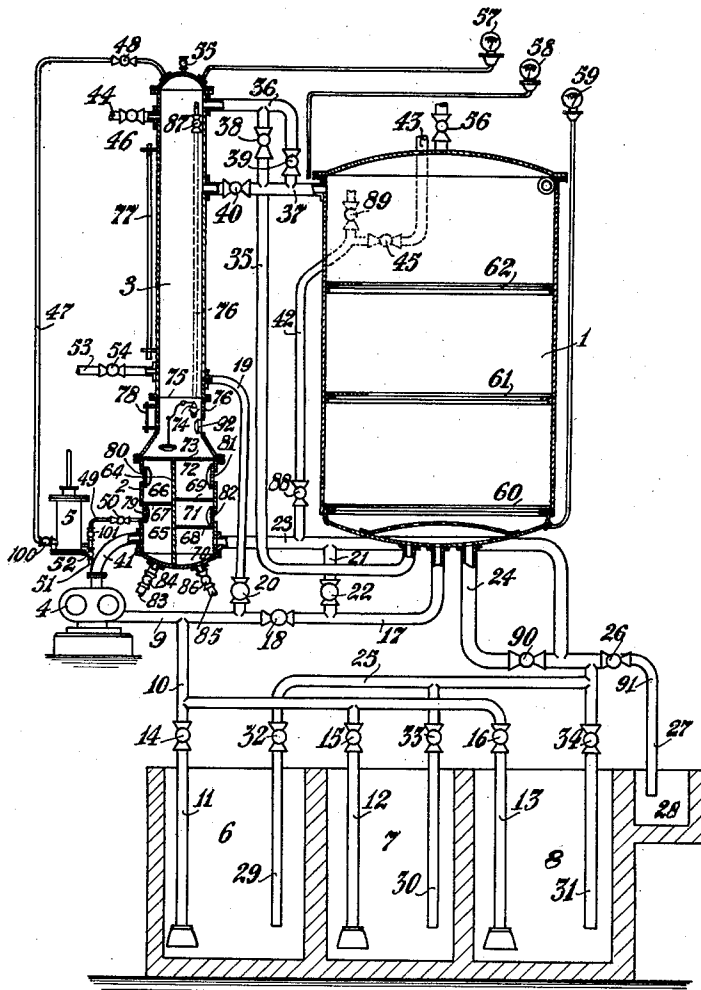
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1,404,467.

Patented Jan. 24, 1922.

2 SHEETS—SHEET 1.

Fig. 1.



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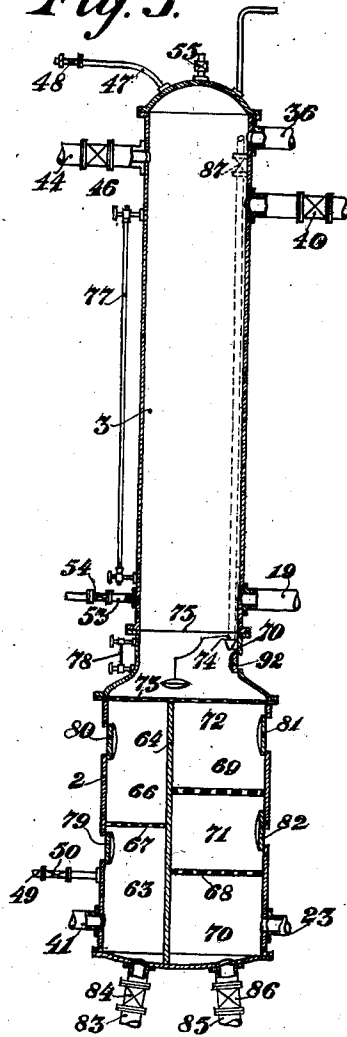
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2 SHEETS—SHEET 2.

Fig. 2.



Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD AND DEVICE FOR BLEACHING TEXTILE FIBERS AND FABRICS, TISSUES, AND
THE LIKE.

1,404,467.

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To all whom it may concern:

Be it known that I, ROBERT MOHR, residing at Eibergen, Netherlands, have invented certain new and useful Improvements in
5 Methods and Device for Bleaching Textile Fibers and Fabrics, Tissues, and the like, (for which I have filed applications in Germany, Sept. 14, 1916, Patent No. 311,546, and in Holland, Feb. 20, 1919,) of which
10 the following is a specification.

This invention relates to a process and apparatus for bleaching textile products, textile fibers and the like, without boiling and by means of chlorine or oxygen, whereby loss
15 of chlorine and oxygen is prevented as much as possible, and the gas that is liberated from the bleaching liquor is collected and returned to the latter to be absorbed therein. As is well known, chlorine or active
20 oxygen is liberated very quickly at high temperatures and these gases are then regarded as lost in the process hitherto in use. The designed apparatus aims to prevent such losses.

25 The process consists in first charging the bleaching vessel with goods to be bleached and with the bleaching liquid. The vessel is then closed and a pressure of 2-3 atm. is developed and maintained. The bleaching
30 liquid is kept in circulation passing not only through the bleaching vessel but also through an expansion vessel and a filtering or saturating tank or both.

Care should be taken that the air is
35 pumped out of the expansion vessel until a continuous vacuum is obtained. The bleaching gases developed in this vessel are returned into the saturating tank, while the liquid in this vessel passes a filtering material, so as to remove the suspended particles.

Devices wherein other reservoirs are connected with the vessel are known. These however differ materially in construction
45 and function from the device of the invention inasmuch as this latter is intended to prevent the presence of air in the vessel to keep up the strength of the bleaching liquids and to effect continuous cleansing.

50 The chlorine or oxygen which is set free

is according to this invention sucked by a compressor again and the bath is saturated anew in a saturating vessel. Accordingly only the quantity of a bleaching agent required for the goods is used. Therefore
55 there are no losses, the process is more economical and the bleaching action of the liquid lasts longer. As the process is carried out under pressure the bleaching power of the active oxygen is much greater and accordingly the bleaching action is remarkably strong.

The device to be specified below in connection with the process is such as to make possible the treatment of the raw materials
65 and products of the textile fabrication with different baths. Either chlorine, acid or oxygen may be used and finally an after-treatment with soap.

In the process according to the invention 70 the bath can be used as economically as possible and in case of cotton efficient bleaching without boiling is effected. The working temperature need not exceed 80° C. Linen yarn needs only one single previous
75 boiling with 2% chlorine and passes out of the device nearly bleached, while in the process hitherto in use three or four boilings were required. The treatment in the device is exceedingly delicate and gives little
80 chance to damage, so that it is possible to bleach also fine materials in particular curtains, lace and like materials.

In the accompanying drawings Fig. 1 shows a device schematically partly in side
85 view. Fig. 2 is a detail in section and Fig. 3 shows the filtering and saturating vessel with appurtenances on a larger scale.

The device consists of a bleaching vessel 1, a saturating and filtering vessel 2, an expansion tank 3, a circulating pump 4, an air pump or compressor 5, the vessels 6, 7 and 8 for the liquid, and pipes connecting these parts and provided with cocks for controlling the direction of the bath liquid. 95

Connected with the suction pipe 9 of the pump 4 by means of a pipe 10 are the suction pipes 11, 12 and 13 of the bath liquid reservoirs 6, 7 and 8, which suction pipes are provided with cocks 14, 15 and 16, the pipe 100

9 is also connected to the bleaching vessel 1 at the bottom by a pipe 17 having a cock 18, and to the expansion vessel 3 below by a pipe 19 having a cock 20 and also to the filtering vessel 2 by a communication pipe 21 with cock 22 issuing from the part 17. A connection pipe 23 ends in an outlet pipe 24, which issues from the bottom of the bleaching vessel 1. To the pipe 24 are connected the common return pipe 25 to the liquid reservoirs 6, 7 and 8 and the outlet pipe 27 provided with a cock 26 to the outlet channel 28. Three return pipes 29, 30 and 31 of the liquid reservoirs 6, 7 and 8 are connected with the return pipe 25 and are provided with cocks 32, 33 and 34. The bleaching vessel at the bottom is connected by a vertical pipe 35 with pipe 36, which runs from the top of the expansion tank 3 to a tube 37 immediately connecting the bleaching vessel with the expansion tank. The pipe 35 is provided with cock 38 before the connecting point with tube 36 and the latter tube is in the same way provided with a cock 39 before the connecting point with tube 37. The connecting tube 37 is provided with a cock 40 between expansion tank 3 and the connection with tube 36. Pump 4 is connected with the filtering and saturating vessel 2 by a delivery pipe 41, the pipe 23 issuing from the saturating vessel is connected with pipe 42, which is connected with the upper part of the bleaching vessel. The latter and expansion vessel 3 have water-supply pipes 43 and 44 provided with cocks 45 and 46 respectively. The compressor 5 is connected on the one hand by a pipe 47 provided with cocks 48 and 100 with the top of the expansion vessel 3 and on the other hand by a tube 49 provided with cocks 50 and 101, with the lower parts of the filtering and saturating vessel 2. A pipe 51 with cock 52 branches from tube 49, before the cock 101.

The expansion vessel 3 has below a steam supply pipe 53 provided with cock 54. Expansion vessel 3 and bleaching vessel 1 are provided at the top with air cocks 55 and 56 respectively.

The manometers 57, 58 and 59 are connected respectively with the upper part of the expansion vessel 3 with the connection tube 37 between the latter and the bleaching vessel 1 and with the lower part of the bleaching vessel.

The bleaching vessel is divided into a plurality of sections e. g. three, according to the quality of the goods to be bleached and the size of the vessel, by means of removable perforated bottoms 60, 61 and 62. These bottoms consist of three parts with a view to the ready removal and returning and are constructed as liquid distributors. Fig. 2 shows such a bottom in section. It consists of a grating of bars, lens shaped in section,

arranged at a distance of about 2 mm. apart, for carrying the goods under treatment.

These liquid distributors completely prevent the passage of the goods and as the liquid is checked against the grating, it distributes itself and sprinkles the goods below. Furthermore the packing of the goods is prevented because the goods are carried by the grating. Where the pipes 17, 24 35 discharge into the bottom of the bleaching vessel their ends are covered with a curved sieve. The upper part of the filtering or saturating vessel 2 is narrower than the lower part. The lower part is divided into two compartments by vertical partition 64, one of which compartments is connected with the pumps 4 and 5 and is divided into two subdivisions 65 and 66, which are separated by a sieve 67, while the other compartment is divided into three subdivisions 70, 71 and 72, by means of two sieves 68 and 69. The upper subdivisions 66 and 72 are separated by a sieve 73 from the uppermost narrow space of the filtering and saturating vessel. At this place a float valve 74 is provided below the bottom, separating the two vessels 2 and 3. The float valve 74 cuts off a connecting pipe 76 opening into the upper end of vessel 2 and discharging at the other end below the cover of the expansion vessel 3. This pipe is provided with a cock 87. The expansion vessel 3 is provided with a gauge glass 77 and in the same way the upper part of the vessel 3 is provided with a gauge glass 77. The subdivision 72 of vessel 2 is charged with coarse excelsior and the subdivision 71 with fine "excelsior." The subdivisions 65, 66, 71 and 72 have manholes 79, 80, 81 and 82 for cleansing purposes. The float valve in the upper part of the filtering and saturating vessel may be examined by means of a manhole 92; moreover both compartments or divisions are provided at the bottom with discharging tubes 83 and 85, having cocks 84 and 86 respectively. Finally pipe 42 has another cock 88 in the lower part and the cock 89 in the upper part between the place of discharge into the bleaching vessel and the connection with the water conduits.

With this device all kinds of fabrics woven from vegetable fibers light or heavy can be bleached completely after previous maceration and more efficiently than hitherto by either sodium hydroxide or lime bleaching. The formation of oxycellulose and stains, damages and deformation of the material by rough treatment are excluded, besides the bleaching is cheaper than with any known bleaching process. A different treatment can be executed subsequently without removing the goods from the apparatus. In this way the goods are saved besides the required labour being less. The saving of

the goods is chiefly effected by making the boiling superfluous.

Supposing that the tank 6 contains the chlorine bath, the tank 7 the diluted acid bath and the tank 8 the oxygen bath the process may be carried out in the following manner:

In the first place, after all the cocks having been shut and the bleaching vessel charged with the goods a chlorine treatment under pressure takes place which is not new in itself. The cocks 14, 22 and 39 and the air cocks 55 and 56 are opened and the bleaching water is pressed from below to the top through the bleaching vessel by means of the pump 4. The liquid passes through the tubes 11 and 9, the pump 4, the tube 41, the filtering and saturating vessel 2, the tubes 23, 21, 17 to the bleaching vessel. As soon as the liquid issues from the air cock 56, the same is shut and pumping is continued until the expansion vessel 3 has been filled; then the air is expelled from the expansion vessel from which the liquid flows over through the pipe 36. The cock 14 and the air cock 55 are then shut off and the cock 20 is opened. The bath liquid then passes through the bleaching vessel for instance by rising from the bottom to the top of the bleaching vessel, from the latter through the tubes 37, 36, the expansion vessel 3, the tubes 19 and 9 to the pump 4 and from this point returns through the tube 41, to the saturating and filtering vessel 2 and the tubes 23, 21 and 17 to the bleaching vessel. This takes about a quarter of an hour, whereupon the cock 39 is gradually shut off until the manometer of the bleaching vessel indicates 2 atm. Then cock 39 is again gradually opened so as to maintain a pressure of 2 atm. Next cocks 48, 100 and 52 are opened and the air pump is started. After the pump has operated for 10 minutes until a vacuum of some millimeters having been formed by exhausting the air present in the expansion vessel, cock 101 is opened and cock 52 closed. In this way according to the invention the escaping chlorine containing gases from the bath which then is in operation is pressed into the saturating vessel. The chlorine containing liquid there absorbs the liberated chlorine gases and is saturated with them. The gases which are not absorbed rise to the upper parts of the saturating and filtering vessel, while the liquid passes on through the filtering chambers to the bleaching vessel. The gases collected in the upper space of the saturating and filtering vessel cause the bath liquid to flow back. The float sinks while the valve 74 is opened, the gases return through tube 76 and cock 87 into the expansion vessel. After an hour the pumps are stopped. The cocks 39 and 22 are closed and cocks 38, 88 and 89 are opened and the

pumps 4 and 5 started. Now the bath liquid is pressed by means of a pump 4 through tube 41, saturating and filtering vessel 2, tubes 23 and 42 into the upper part of the bleaching vessel through which it passes down and is discharged and returns by the tube 35, the expansion vessel 3, tubes 19 and 9 to the pump. By means of cock 38 the pressure in the bleaching vessel is kept as before at 2 atm.

The air pump sucks the gases rising from the liquid in operation and returns then as before to the bath. If during the circulation of the bath liquid in the bleaching vessel a greater pressure in the upper part of the bleaching vessel should occur than can be controlled by the manometers 58, 59, this over pressure can be equalized by cock 39. If on the other hand a larger pressure should occur in the lower part of the vessel the equalization is likewise obtained by opening cock 39. When the chlorine treatment is finished the pumps are stopped, all cocks closed and after this cocks 20 and 32 opened and pump 4 started. The latter forces the bath liquid out of the expansion vessel 2 back to the tanks. When the expansion vessel is emptied cock 20 is closed and cock 18 opened, so that now the pump 4 discharges the contents of the bleaching vessel into the tanks, without the air cock 56 being opened, thus preventing the admission of air. When the bleaching vessel is emptied, cock 18 is closed the pump stopped and cock 32 also closed. A vacuum now prevails in the bleaching vessel which renders the formation of oxycellulose and stains impossible. The cocks 89 and 45 are now opened and the bleaching vessel filled with water; after which the air cock 56 is opened, rinsed with water. At the same time cocks 89 and 43 are opened, in order to wash the expansion, saturating and filtering vessels. The washing is continued until the water does not show any reaction, that is to say until iodide of potassium—starch paper is no longer colored. At this point the mass is subjected to a bath of a weak acid which is pumped up by means of pipe 4 to the bleaching vessel out of the acid tank by opening the corresponding cocks, 15, 22 and 39, and after cock 15 having been closed and cock 20 opened the circulation proceeds for half an hour. Whereupon the acid is returned to the tanks by opening and closing the corresponding cocks and washing as before.

Proceeding in this way it is possible to bleach dyed articles or goods of all kinds in the same way as with the usual bleaching with sodium hydroxide, so that they may be used for dyeing with the brightest coloring shades. A full heavy tissue results as the boiling is omitted; the luster of the cotton remaining more natural.

For the bleaching with oxygen under pressure the oxygen liquid i. e. peroxide of hydrogen to be used is sucked from the corresponding tank in the same way as previously occurred with chlorine or acid containing liquid, and forced from top to bottom into the bleaching vessel, exactly as in the chlorine treatment. Instead of cock 14 however cock 16 must be opened. For the rest the position of the cocks is as shown in Fig. 1. When therefore, bath liquid is discharged from the air cock 56 this cock is closed and cocks 55 and 39 opened, until the expansion vessel is filled. Thereupon the pump 4 is stopped, cocks 39, 55 and 16 are closed and the cock 20 is opened. The pump 4 therefore pumps from the expansion vessel to the liquid vessel. When a pressure of 2 atm. prevails cock 39 is opened to such an extent that the pressure is maintained. If a higher pressure occurs in the upper part on account of the goods not being sufficiently penetrable, cock 38 is opened so as to equalize the pressure. The steam valve 54 is then opened and steam admitted until a temperature of 70–80° C. is attained. After about three hours exactly as in the case of the treatment with chlorine the movement is reversed and checked by means of cock 38. If the pressure in the upper part is greater than below, the cock 39 is opened until the pressure is equalized in order to prevent the goods to be bleached from being pressed together. At high temperature much active oxygen escapes which is collected in the upper part of the expansion vessel. Hence this oxygen is sucked away again by the compressor 5 and forced into the saturating vessel where it is absorbed again by the liquid partly weakened in its action. In case the liquid is unable to absorb oxygen containing gases the latter are collected in the upper space of the separating and filtering vessel and are returned in the above described manner by means of the float valve 74 to the expansion vessel 3 and sucked again and passed into the saturating vessel. After the bath liquid has circulated during three hours from the bottom to the top $\frac{1}{2}$ % of soap is added to the oxygen bath and admitted gradually by a tube into the expansion vessel. The liquid reduced to 1 gram of active oxygen is rendered active again by the soap. The operation is continued for another two hours with soap oxygen liquid and afterwards the process is stopped. The bath liquid is used for impregnating and macerating the raw goods and the bleached goods washed and prepared for further treatment.

In the case of Indian or Egyptian cotton either in the form of yarn or fabrics (curtains, lace work) it is necessary to apply the treatment of chlorine and oxygen. In the case of all other kinds of cotton the former

should only be used with dyed goods and the latter with white goods. The chlorine-treatment is preferred on account of its cheapness in the case of dyed goods. If desired a treatment with oxygen can also be applied; in no case a boiling is needed. For figured white goods the oxygen treatment is advisable only at temperatures not exceeding 60° C.

The chlorine treatment under pressure and in vacuum has for its object to completely bleach the knobs which are already partly decomposed by the impregnation so that they are no more visible.

The chlorine is strongly forced into the fibers but without pressing together the material; the air present escapes so that a much more regular and more effectual bleaching is obtained than with all other apparatus. The escaping chlorine gas is sucked away and again added to the bath liquid.

The result hardly obtained in other bleaching processes by boiling is attained by the above described oxygen treatment and even surpassed.

The sieves 63 arranged in the saturating space of the filtering and saturating vessel cut off the streams of the entering liquid and cause the gases forced into the vessel by the compressor to mix thoroughly with the liquid and be absorbed by it, so that the liquid enters the filtering space entirely saturated.

The filters retain the harmful crystals during the chlorine treatment to prevent their introduction into the goods. This is also the case with any other impurities which may give rise to the formation of stains. All suspended particles of the sodium-peroxide are left behind in the filters; should these particles be introduced into the goods they would have a destroying influence, but are now gradually dissolved.

In the upper part of the bleaching vessel a distributor 93 is arranged, connected with the tube 42. Cock 40 is used if the liquid should be brought into circulation in the open vessel.

What I claim is—

1. The process of bleaching textile fabrics and products, which consists in circulating a bleaching fluid in a closed circuit through the material to be bleached, filtering the fluid in a portion of the circuit, withdrawing gas at another portion of the circuit outside the bleaching zone, and returning the gas into the filtered fluid on its return passage to the material.

2. The process of bleaching textile fabrics and products, which consists in circulating a bleaching fluid under pressure in a closed circuit through the material to be bleached, filtering the fluid in a portion of the circuit while under pressure, withdrawing gas separated from the fluid at another portion of

the circuit outside the bleaching zone, and returning the gas under pressure into the filtered fluid on its return passage to the material.

5 3. The process of bleaching textile fabrics and products, which consists in circulating a bleaching fluid under a pressure of 2 to 3 atmospheres in a closed circuit through the material to be bleached, withdrawing gas
10 separated from the fluid outside the bleaching zone, filtering the fluid and gas under pressure at another portion of the circuit outside the bleaching zone, and returning the filtered gas to the filtering zone.

15 4. An apparatus for bleaching textile products and raw materials, comprising a bleaching vessel, a plurality of fluid tanks adapted to communicate with the vessel at the lower part of the latter, an expansion
20 vessel and a filtering vessel communicating with the bleaching vessel, a circulation pump communicating with the filtering vessel, a valved conduit connected to the expansion and filtering vessels, a compressor connected
25 with the expansion and filtering vessels, and means whereby the pump and compressor may be directly and indirectly brought into communication with the bleaching vessel.

5 5. An apparatus for bleaching textile fabrics and raw material, comprising a bleaching vessel, a plurality of fluid tanks, pipes
30 connecting the latter with said vessel, a circulation pump connected with the top and bottom of the latter, a saturating and filtering vessel in the circuit between the pump
35 and bleaching vessel, an expansion vessel connected with the pump, a conduit connecting the saturating and expansion vessels, a float valve in the saturating vessel for
40 controlling the conduit, conduits connecting

the expansion vessel with the upper and lower ends of the bleaching vessel, a compressor connected with the expansion and saturating vessels, and means whereby the pump and compressor may be connected
45 through the expansion and saturating vessels with the bleaching vessel.

6. An apparatus for bleaching textile fabrics and raw material, comprising a bleaching vessel, a plurality of fluid tanks, means
50 including a pump for pumping fluid from the tanks into the vessel, a saturating and filtering vessel interposed between the pump and vessel, an expansion vessel, a conduit connecting the top of the latter with the
55 top of the bleaching vessel, a conduit connecting the bottom of the expansion vessel with the pump, a compressor connected with the expansion vessel and the saturating and filtering vessel, a conduit connecting the
60 upper end of the latter with the upper end of the expansion chamber, and a float valve for controlling the lower end of the latter conduit.

7. A bleaching apparatus comprising a
65 plurality of fluid tanks, a bleaching vessel, conduits connecting the tank and vessel, an expansion vessel, a pump for circulating liquid through the vessels, a saturating and
70 filtering vessel interposed in the circuit between the expansion and bleaching vessels, the lower part of the saturating and filtering vessel being wider than the upper part thereof, a sieve separating said upper and
lower parts, and a plurality of sieves forming
75 compartments in said lower part to receive a filtering material.

In testimony whereof I affixed my signature.

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