Aug. 13, 1940. H. F. LEWIS ET AL 2,211,138

PREPARATION OF RAGS FOR PAPER MAKING

Filed Dec. 4, 1935 2 Sheets-Sheet 1

Fig. 1.

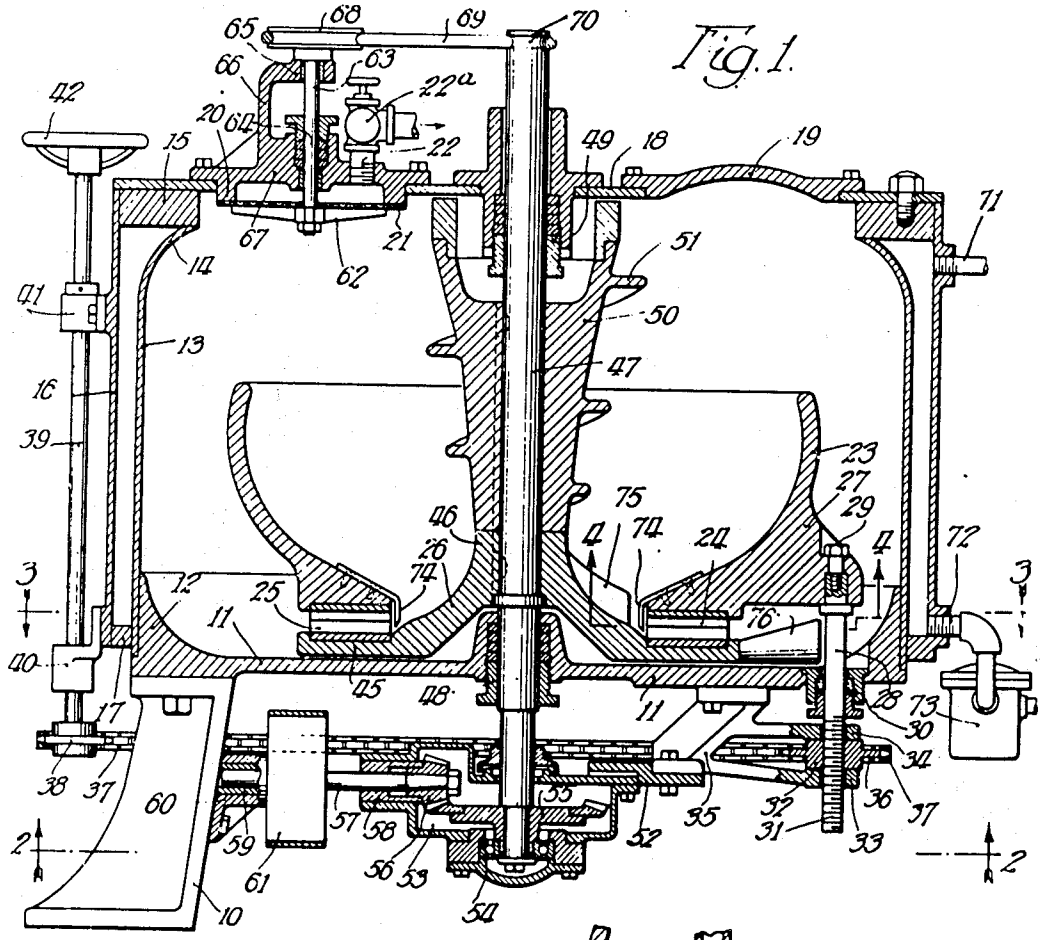
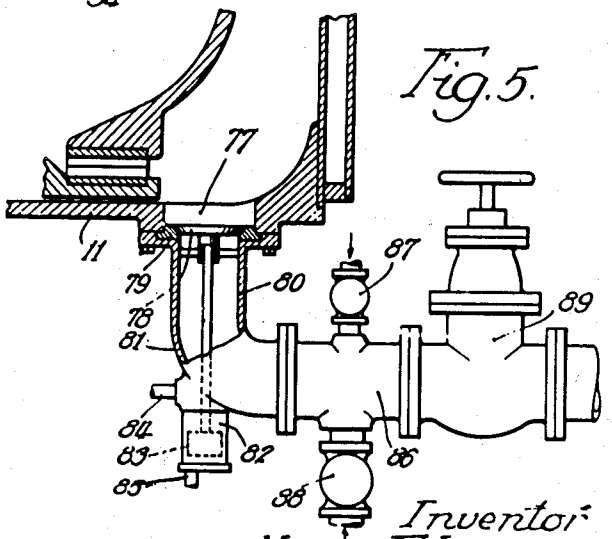


Fig. 5.



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Fig. 2

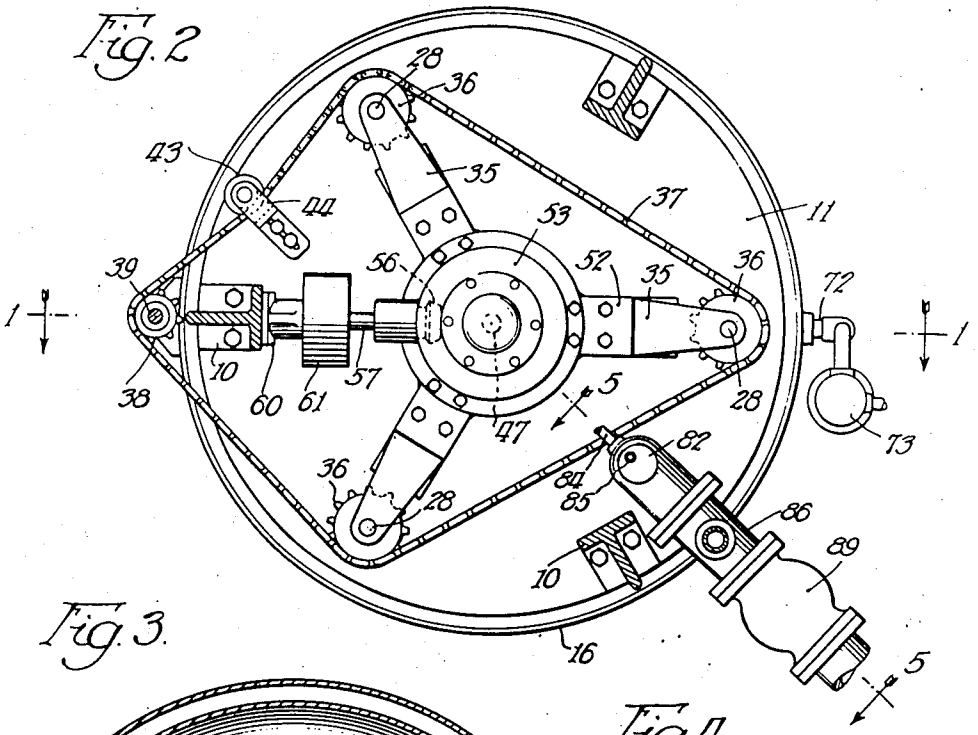


Fig. 3.

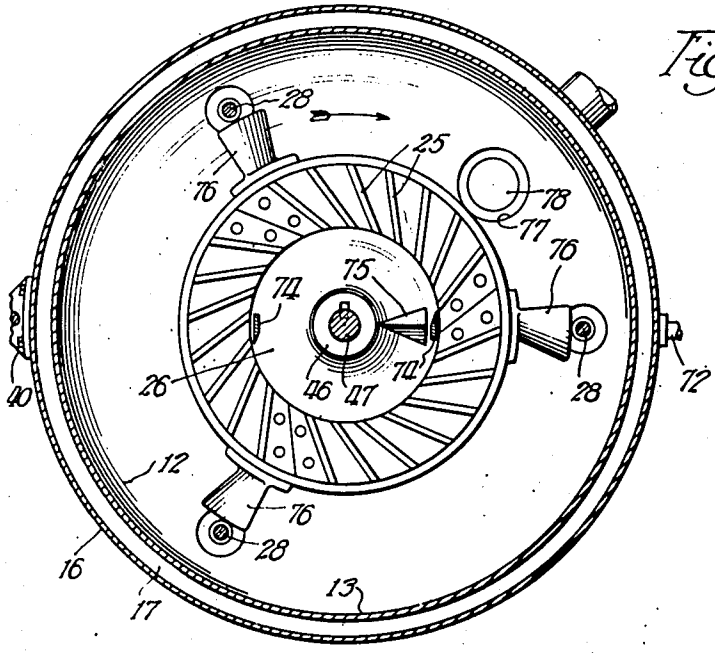
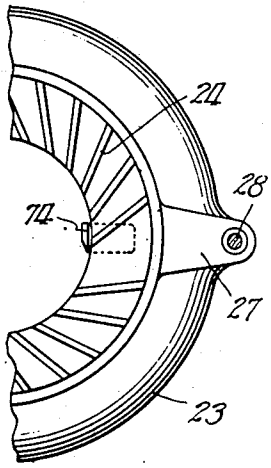


Fig. 4.



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PREPARATION OF RAGS FOR PAPER MAKING

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Application December 4, 1935, Serial No. 52,748

3 Claims. (Cl. 92—16)

Our invention relates to improvements in the preparation of rags for paper making and its principal objects are to provide a process and apparatus by which the rags are freed from dyestuffs or other undesirable materials which would interfere with the full utilization of the rag stock in the manufacture of paper, to reduce the time required in the preparation of the paper stock from rags, to provide an improved quality of stock from rags, and, in general, to provide an improved process and apparatus of the character referred to.

Heretofore, so far as we are aware, the preparation of rags for use in the making of paper-making stock has involved a series of operations carried on in a more or less disconnected way and at different times with different equipment located in different parts of the paper mill. Such prior art processes have involved the handling of the rags repeatedly and the transporting of the material in more or less solid form from place to place in the mill until the various series of disconnected steps of the rag preparation process have been completed. Also, so far as we are aware, no thoroughly successful process has been worked out for the purpose of eliminating certain types of coloring matter by which the cloth had been originally dyed. Also, in addition to elimination of the dyestuffs, we believe that no very practical method has ever been evolved for the purpose of eliminating waxes, other loading materials and the like.

One important feature of our invention consists in the carrying on of the entire series of rag preparation steps as a practical continuous process, the term "continuous" in this sense, meaning treating or working a batch of stock in a single apparatus, or apparatus group without any material interval between the consecutive steps of the process.

According to the preferred method of operation, the rags are first treated in a beating engine or other suitable apparatus for divellicating the fibers, i. e., disintegrating the rags to such an extent by mechanical action that the individual fibers are separated from each other and are exposed to any chemical treatment to which it may be desirable to subject the stock in order to remove the undesired dye or other materials.

After the fibers have been sufficiently separated, they may be first washed and then they can be treated with the necessary chemicals for loosening and removing the adherent dyestuff or other foreign matter adhering to the individual fibers. After the chemical treatment has been completed the fibers are then thoroughly washed and subjected to any other treatment which they may require before they are introduced into the paper-making batch. During all of these steps of the process the fibers being water borne may be vigorously agitated so that each individual fiber is acted upon and is fully responsive to the particular treatment to which it is being at that time subjected. In view of the fact that certain materials, particularly certain dyestuffs, require chemical treatment at high temperatures, frequently higher than that of boiling water, the equipment used in the process must be enclosed and capable of withstanding substantial pressures above that of the atmosphere.

As a specific example of an equipment which may be used for practicing the process, we have disclosed herein a modified beater of the type disclosed in the U. S. Patent to Seaborne, No. 1,691,308, issued November 13, 1928, which type lends itself particularly well to a construction which will withstand the pressures to which the stock may have to be subjected during the process.

In the drawings accompanying this application—

Fig. 1 is a vertical section through the center of the beater.

Fig. 2 is an underside plan view of the same, looking in the direction of the arrows 2—2 in Fig. 1,

Fig. 3 is a sectional plan taken on the line 3—3 of Fig. 1,

Fig. 4 is a fragmentary section taken on the line 4—4, and

Fig. 5 is a section taken on the line 5—5 of Fig. 2.

Describing first the apparatus used in carrying out the process, it will be seen that the equipment is supported upon a series of three legs 10, to the upper ends of which is bolted a heavy plate or disc 11, which constitutes the bottom wall or floor of the beater. Said plate 11 at its outer edge is made with an upwardly extending flange which forms a fillet or radius 12 around the outer edge of the disc 11 and between the disc and the vertical wall 13 which forms the inside wall of the beater.

The upper end of the cylindrical side wall 13 is made with a radius 14 and supports a closure ring 15, the outer edge of which is united to an outer cylindrical casing 16 spaced from the inside wall 13 to form a jacket for the introduction of heating, and, if desired, cooling fluid. The lower

end of the hollow jacket is closed by a ring 17 to which the lower ends of the cylindrical walls 13 and 16 are suitably united.

The upper end of the beater is enclosed by a top plate or disc 18 which is equipped with a suitable filling opening normally closed by means of a bolted cover 19. Said top plate 18 is also equipped with a pocket in its underside, formed by a circular depending flange or projection 20, on the underside of which there is suitably secured a screen 21, preferably of mesh equivalent to that of a Fourdrinier wire. The upper wall of the pocket is apertured to receive the lower end of a wash-water discharge pipe 22.

Within the beater chamber and concentric therewith, there is adjustably supported a stator which comprises an open topped bowl or curved annulus 23 on the underside of which there is arranged in a horizontal plane an annular series of stationary inclined spaced knives 24, see also Fig. 4. These knives 24 cooperate with a similar set of oppositely inclined knives 25 carried by a rotor 26. The rotor 26 is supported and rotated in a fixed vertical position, the adjustment between the knives being effected by elevating or depressing the stator bowl 23. This is effected by carrying the stator on a series of three lugs 27 which in turn are supported by vertically adjustable posts or columns 28. The shouldered heads or upper ends of these columns 28 are fixedly secured in the lugs 27 by means of lock screws 29, the lower parts of said columns being cylindrical and extending downwardly through stuffing boxes 30 in the lower base plate 11. The depending ends of the posts 28 are threaded as shown at 31 and extend through cooperating threaded collars 32. Each of said collars is supported so as to fit snugly between the spaced upper and lower arms 33 and 33 of a bracket 35 bolted to the underside of the base plate 11. Integral with each of the collars 32 is a toothed flange 36 which cooperates with a chain 37 trained around all three of the sprockets 36.

The chain 37 is also trained around a sprocket 38 keyed to the end of a vertical shaft 39, journaled in brackets 40 and 41, bolted to the exterior wall 16 of the beater jacket. To the upper end of the shaft 39 there is keyed a hand wheel 42, by means of which the shaft 39 can be rotated, which rotation by means of the chain 37 and the sprockets, causes a uniform rotation of the threaded sprockets 36 on the threaded lower ends of the supporting posts 28, so that the bowl can be adjusted up and down in the beater. Any slack which exists or develops in the chain 37 may be taken up by means of an idler pulley 43 which is mounted in a horizontally adjustable bracket 44, bolted to the underside of the base plate 11.

As has been previously stated, the moving knives 25 of the beater are mounted on the lower end 26 of the rotor. This lower end comprises a horizontally extending flange portion 45 which carries the knives, and a more or less conical portion, the upper end of which is in the form of a hub 46. The hub 46 is keyed to a central vertical shaft 47, the lower end of which extends through a stuffing box 48 in the base plate 11, and the upper end extends through a stuffing box 49 in the cover plate 18. Above the hub 46 there is also keyed to the shaft 47 a tapered or hub-like part 50 on the exterior of which there is formed a screw thread 51 which serves the purpose of a propeller for moving the central portion of the stock in a more or less vertical direction.

The shaft 47 is driven at its lower end by means of the following train of mechanism. Beneath the base plate 11 of the beater, there is a frame plate 52 which is bolted to the lower ends of the brackets 35 previously described. On the underside of said plate there is mounted a cover 53 which carries at its lower side an enclosed bearing 54 for the lower end of shaft 47 and also serves to enclose the gearing for driving the shaft. Said gearing comprises a large beveled gear 55 keyed to the lower end of the shaft 47 and a beveled pinion 56 keyed to the end of a shaft 57, journaled in a bearing 58 at one side of the plate 52, and in a bearing 59 carried by a bracket 60, secured to the inside of the base of one of the main supporting legs 10. The shaft 56 is rotated by means of a pulley 61 driven by a belt not shown.

In order to prevent clogging of the screen 21, we prefer to equip the underside of said screen with a two-bladed scraper 62 which is keyed to the end of a vertical shaft 63, extending through a stuffing box 64. The upper end of the shaft 63 is supported in a bearing 65, at the upper end of a bracket 66, formed as a part of the upper side of the cover member 67. On the extreme upper end of the shaft 63 there is keyed a grooved pulley 68 driven by a round belt 69 passing around a corresponding groove 70 in the upper end of the main shaft 47.

Steam for heating purposes or cold water for cooling purposes may be admitted to the jacket through a pipe 71 and the water of condensation or other water admitted to the jacket can be removed through a discharge pipe 72. In the case of steam, the water of condensation passes out through a suitable trap 73.

In order to prevent the rags or rag particles from collecting at the inside edges of the knives 25, we prefer to secure to the lower edge of the bowl 23 of the beater, a pair of cutting knives 74. Also, in order to obtain a proper distribution of stock, it may be advisable to employ one or more cam-like projections 75 on the rotor 26.

In certain cases, we find it advisable also to secure to the outer edge of the lower flange part 45 of the rotor one or more, in this case, three, plow-like members 76, wedge-shaped in vertical cross-section, which serve to plow up from the bottom of the beater any accumulation of rags or stock so that the same will be properly circulated in the tank of the beater.

In the bottom plate 11 at one side of the same, there is provided an opening 77, large enough to offer no material obstruction to the flow of finished stock. The lower end of said opening is normally closed by means of a mushroom valve 78 seated in a ring 79, secured to the upper end of a housing 80 which is bolted to a flange on the underside of the base plate 11 and surrounding the opening 77. Said housing 80 is in the form of a hollow elbow so that the lower end of the stem 81 which carries a poppet valve 78 may extend downwardly vertically and outwardly into a control cylinder 82. Within the control cylinder 82 there is adapted to reciprocate a piston 83 fixed to the end of the valve stem 81, so that by suitable valve arrangements fluid under pressure admitted to or discharged from the pipes 84 and 85 can be employed to either open or close the valve 78.

On the lower end of the elbow housing 80 there is secured a hollow fitting 86 to which steam may be admitted through a valve 87, or water may be admitted through a valve 88. On the outer end of the fitting 86 there is mounted a large gate

valve 89. The valve 89 is closed whenever it is necessary to admit steam or water into the beater. When it is desired to discharge the finished stock, the valve 89 is opened.

The above described apparatus is capable of use in various ways to suit the particular stock which is to be treated and to suit the particular treatment to which the stock is to be subjected. We will now illustrate the application of the process and apparatus in the treatment of cotton rags dyed with indigo or a combination of indigo with some other dye.

The rags are first cut to size with the usual mill rag cutter after which a charge of the cut rags, weighing 25 pounds is introduced into the beater with about 300 pounds of water. By this time the bowl of the beater is elevated to its fullest extent so that the beater knives 24 and 25 are separated to the maximum extent. The beater is started in operation and after about twenty or twenty-five minutes the fibers are found to be sufficiently divellicated.

If the rags have been dusted the chemical treatment is immediately begun, but if the rags have not been dusted, clear water is admitted through the valve 88 and flows out of the beater through the screen 21 and waste pipe 22, carrying with it any soluble dirt or other substance which can pass out through the screen. It will be understood that during this and other washing operations the beater is preferably continuously actuated so that the stock is thoroughly agitated, and settling is avoided. This insures that each particle of the fiber is thoroughly and efficiently washed. This washing of the fibers is continued for a period of from 10 to 15 minutes after which the valves controlling the water inlet and exit pipes are closed.

To cook or strip the stock, the necessary chemicals are now introduced into the beater. In the present instance, the chemicals comprise .187 pound of sodium hydrosulfite and one pound of flaked sodium hydroxide.

After the chemicals have been introduced, live steam is introduced through the valve 87 at twenty pounds of pressure, and with the knives of the beater fully separated as before, the contents of the beater are vigorously circulated. Also, during this time it will be found advantageous to admit steam also to the jacket through the pipe 71. After a temperature substantially corresponding to 20 pounds steam pressure has been reached, this temperature is maintained for about 40 minutes, after which the admission of steam is discontinued and the pressure is relieved to about 5 pounds per square inch by opening the valve 22a. Cold water is then admitted through the valve 88, and the stock is circulated and washed for about 75 minutes during which time pressure in the beater is maintained at about 5 pounds per square inch. It will be understood that when washing or circulating water through the beater, the beater is completely filled with stock and water and the liquid flows out through the pipe 22 at the same speed at which liquid is admitted through the water inlet valve 88.

Under the conditions of the treatment herein specified, the rags are converted into a stock satisfactory for bleaching without further treatment. This bleaching is readily effected in the beater where the bleaching can be effected by the use of hypochlorite or, if desired, chlorine gas introduced as near the bottom of the beater as possible may be employed. Sulfur dioxide can be used to supplement chlorine or it can be used alone.

In all of the above operations, it is found to be advantageous to work the stock at a relatively high consistency, for example about 6 to 9 percent. Compared with the earlier treatment steps, this consistency obviously is somewhat reduced in the final bleaching step. After the bleaching has been completed, the stock is again washed and is ready to be introduced into the furnish without further treatment except the usual beating step. This final beating of the stock may be effected in another beater in the usual manner or it may be carried out in this same special beater in which the above described process steps are effected, in which case, of course, the spacing of the knives 24 and 25 is reduced in accordance with the usual practice. In order to preserve the strength of the finished stock, it may be advisable to prevent rise of temperature during the beating operation by circulating cold water through the jacket.

The cooking temperature can be varied according to conditions, but ordinarily it is not advisable to use more than 40 pounds steam pressure equivalent to 130° C. because at higher temperatures certain dyestuffs are modified to rather stable form which is correspondingly difficult to eliminate. On the other hand, a fairly high temperature speeds up the treatment so that a temperature of at least 100° C. for the cooking, is usually indicated.

Many indigo dyed denims are sized with wax which usually has a melting point of between 50 and 60 degrees C. In order to effect proper elimination of this material, it should be kept in a finely emulsified condition during the entire operation, so that it will flow out through the screen.

The temperature and time for cooking and stripping depend in part on the nature of the dyestuff and the condition of the rags. New denims dyed with indigo respond successfully to the above described treatment. However, with other dyestuffs there may be a distinct advantage to be gained by a shorter treatment because some of the reduced soluble dyestuffs coming off the goods may be changed chemically in the stripping process to even more stable chemical modification than the original color. For example, in the case of goods dyed with indanthrene, we prefer to carry on the stripping operation at a substantially higher temperature (35 pounds of steam equal to 127° C.) for a shorter time (10 minutes) than in the case of rags dyed with indigo.

The amount of chemicals employed in the stripping process depends upon the quantity of dyestuff present. For denim rags we prefer to use caustic soda in the amount of 4% of the rag weight, and sodium hydrosulfite in the amount of about three-fourths of 1% of the rag weight. Alkaline agents other than caustic soda may be employed, although we prefer caustic soda for rags dyed with indigo. On the other hand, for the purpose of treating shirt cuttings containing indanthrenes, calcium hydroxide appears to be preferable. As stated before, 4%, or between 3 to 5 percent of the rag weight is desirable for use where sodium hydroxide is selected as the alkali to be used, whereas when lime is used, about double that amount is indicated.

Various modifications of the process and of the apparatus will occur to those skilled in the art. Therefore, it is to be understood that the scope

of the invention is to be determined by reference to the appended claims.

We claim as our invention:

1. The steps in a process of preparing indanthrene dyed rags containing indanthrene for paper making, consisting in first mechanically working said dyed rags in water so as to divellicate the rags and form a suspension of separated fibers prior to a chemical treatment thereof, then treating said fibers with an aqueous alkaline hydrosulphite bath at an elevated temperature of about 100° to 130° C., and then washing said fibers.

2. The process of removing indanthrene from dyed rags containing indanthrene and preparing said rags for paper making, consisting in first divellicating said rags in water prior to a chemical treatment thereof, stirring the divellicated rags in a sodium hydrosulphite bath at a temperature of about 100° to 130° C. in order to detach the indanthrene, and then washing the divellicated rags.

3. The process of removing indanthrene from dyed shirt cutting rags containing indanthrene and preparing said rags for paper making, which comprises divellicating said rags in water prior to a chemical treatment thereof so as to form a suspension of separated fibers, then circulating said fibers in the presence of live steam at a temperature of about 127° C. for about 10 minutes in a bath containing about 0.75 per cent sodium hydrosulphite and about 8.0 per cent calcum hydroxide based on the weight of said rags, and then washing the fibers to remove the indanthrene detached by the previous treatment.

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