

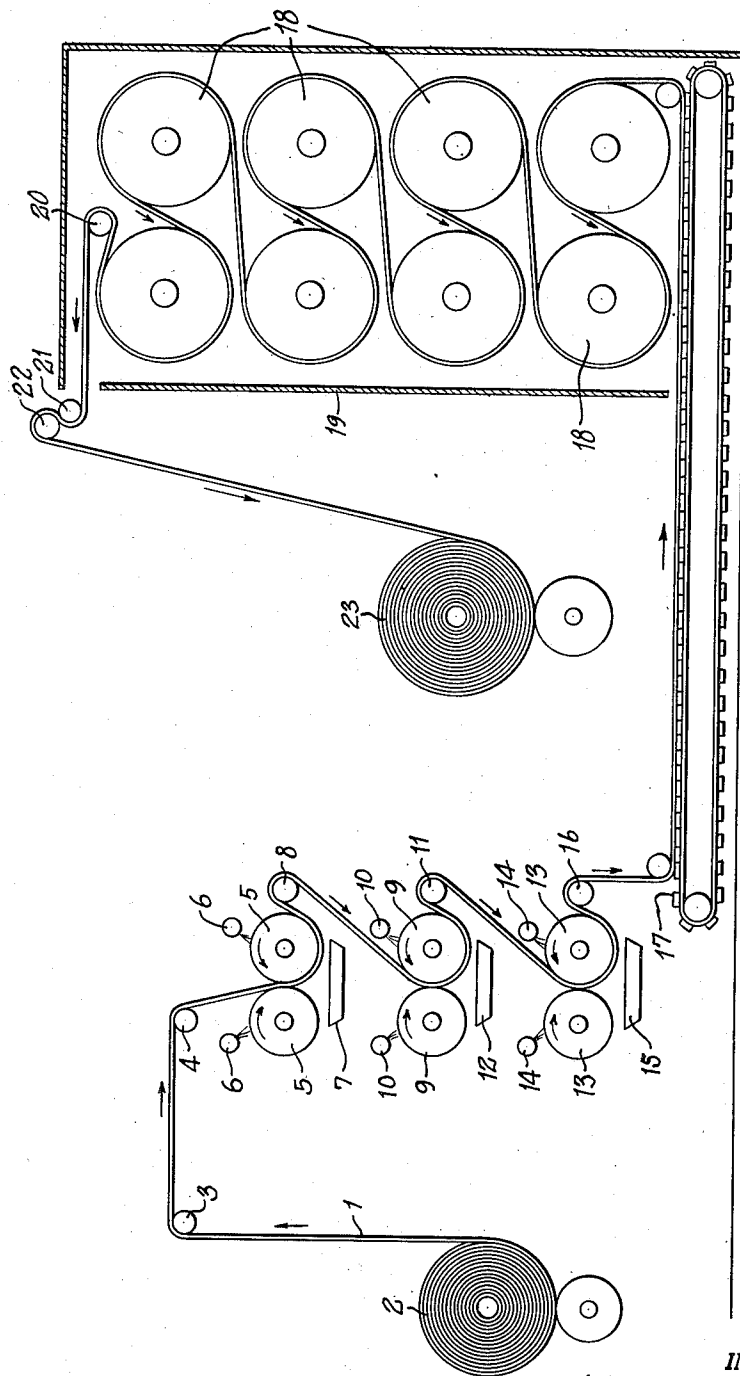
Dec. 9, 1958

M. A. GOLDMAN

2,863,715

WIPING CLOTH AND THE MANUFACTURE THEREOF

Filed Sept. 11, 1952



INVENTOR.

MAURICE A. GOLDMAN

BY

Kenyon & Kenyon

ATTORNEYS

1

2,863,715

WIPING CLOTH AND THE MANUFACTURE THEREOF

Maurice A. Goldman, Woburn, Mass., assignor to Fibre Products Laboratories, Inc., Newark, N. J., a corporation of New Jersey

Application September 11, 1952, Serial No. 309,038

9 Claims. (Cl. 8—115.6)

This invention relates to wiping cloths and the manufacture thereof. It relates especially to wiping cloths for liquid hydrocarbons and the like, namely, a wiping cloth which may be used for wiping machinery or other parts whereby lubricating oil or the like may be removed by absorption by the wiping cloth.

Wiping cloths for absorbing liquid mineral oils and other liquid hydrocarbons are used in relatively large quantities for wiping machinery of all kinds during the use thereof and during installation. The most generally used wiping cloth for the purpose is a woven textile fabric having absorbent characteristics. Generally, the fabric used is a fabric which was originally made and fabricated for other purposes and which has been salvaged for wiping cloth usage. Such fabric as the result of its use for other purposes generally accompanied by repeated launderings is of a soft, porous and absorptive nature. For many purposes, it is desirable that the wiping cloth be as lint free as possible, and this fact imposes further limitations on the quality of the fabric employed. Generally, fabric suitable for wiping cloth purposes costs about 15¢ per 200 square inches of area. This is a substantial cost item in view of the large quantities of wiping cloth material which are required about most plants using machinery. In order to minimize the expense incident to purchasing wiping cloth material many plants, after the wiping cloth material has been used until the amount of absorbed oil makes it no longer efficient for its intended use, wash the wiping cloth material using for the purpose a solvent for the oil such as gasoline, naphtha, kerosene or the like. In large industrial plants the equipment for washing the wiping cloths used therein necessitates a substantial installation. Such equipment requires means for washing the oil from the wiping cloths and since this is done with gasoline or a similar solvent, it is normally desirable to also provide means, such as a distillation unit, for recovering the solvent. The oil which has been removed from the used wiping cloths may also be recovered and used for certain purposes. On the average, the cost incident to the operations involved in washing wiping cloths is about 5¢ per 200 square inches of wiping cloth material.

Any wiping cloth for absorbing liquid mineral oils or the like is required to be substantially unaffected by such oils. Moreover, a wiping cloth should be resistant to solvents such as gasoline, naphtha, kerosene or the like. Such resistance to solvents is necessary not only in case the wiping cloth is washed but also due to the fact that oil wiping cloths are frequently immersed in gasoline or kerosene, after use, and then wrung out in a partially cleaned condition for reuse. Further requirements of an oil-wiping cloth material are that it be of sufficient strength so that it will not tear under normal conditions of use and will not leave small pieces of the material on the machinery. The oil wiping cloth material also should be of such flexibility that it can be caused to conform readily to the machinery parts so as to intimately con-

2

tact the surfaces and absorb mineral oil or the like therefrom. The necessity, in the case of most uses, of an oil wiping cloth being essentially lint free has been mentioned above.

It is an object of this invention to provide a fabric which as initially manufactured is designed for oil wiping cloth purposes. It is a further object of this invention to provide a fabric suitable for use as a wiping cloth for liquid mineral oils and the like which is highly absorptive of such mineral oils and which is unaffected by such mineral oils and by solvents for such mineral oils. It is a further object of this invention to provide a wiping cloth for the purposes stated which, while flexible and adapted to conform to the surfaces of the machinery parts, possesses adequate strength for wiping cloth usage. It is a further object of this invention to provide an oil wiping cloth material which is inherently lint free and can be used in connection with the most delicate machinery. It is an additional object of this invention to provide an oil wiping cloth material having the aforesaid properties which can be manufactured at a cost substantially less than that incident to the purchase of the wiping cloth materials conventionally used at the present time.

It is one of the features of this invention that an oil wiping cloth is afforded which comprises butadiene-acrylonitrile copolymer resin distributed on and among cotton fibers comprised in an unspun sheet-like body. It is a further feature of this invention that a substantial amount of the cutose coating of the natural cotton fibers is retained on the cotton fibers in modified form resulting from the action of an acid on the cutose coating, the modified cutose coating of the cotton fibers acting as a surface cement by which the butadiene-acrylonitrile copolymer resin as disposed on and among the fibers is caused to firmly adhere thereto.

During the initial growth of cotton fiber, the cell wall is first formed of pectose, waxes and primary cellulose. This is called the cutose or cuticle and contains up to 6% pectose which acts as a cement in the cellular fiber structure. As the fiber grows secondary cellulose is formed inside the cutose and the cutose remains as a coating on the cotton fiber. While in the mature fiber as a whole the percentage of pectose is lower than during initial growth of the fiber, nevertheless, the amount of pectose in the cutose coating remains approximately the same as that in the cutose during the initial growth of the cotton fiber. Usually, the amount of pectose in the cutose coating is in the neighborhood of about 6% thereof.

In the practice of this invention, the cotton fiber employed is one which has on the surface thereof either all or a substantial amount of the cutose coating of the natural cotton. Such cotton fiber in the gray state or substantially so is initially formed into a sheet wherein the cotton fibers are disposed in unspun relation. Ordinarily, this is accomplished by a conventional carding operation and a sheet of cotton fibers which has been produced by carding the fibers while in the gray state is well suited for use according to this invention. However, the cotton fibers may be disposed in other ways in unspun relation as, for example, after the fibers have been drawn to a greater or less extent. In a sheet of carded cotton fibers the fibers have some orientation in the machine direction, but have substantial disposition in other directions. The extent of orientation of fibers can be increased by an operation such as drawing, and drawing to a more or less extent can be resorted to if strength characteristics in any particular direction are desired. Moreover, sheets or webs of drawn unspun fibers can be plied on top of each other with the fiber directions in the plies the same or at

angle to each other as may be desired. The thickness of the unspun sheet that is employed may be any thickness which is sufficient to permit the sheet to be handled up to whatever weight of fabric is desired for wiping cloth purposes. Ordinarily, the sheet of unspun gray cotton fibers which is the most economical and also possesses superior all-around utility for most purposes, is that which results from a conventional carding operation. By way of example, in the manufacture of a typical oil wiping cloth according to this invention a carded sheet of gray cotton fibers may be used which is such that 10 yards, about 36 inches in width, weighs about 1 pound.

The butadiene-acrylonitrile copolymer is disposed on and among the fibers by coagulation of the resin in situ from an aqueous dispersion thereof. Also, the cutose coating of the cotton fibers is modified so as to act as a surface cement for the butadiene-acrylonitrile copolymer resin disposed on and among the fibers by subjecting the cutose coating of the cotton to the action of a mineral acid. Since the mineral acid which modifies the cutose coating of the cotton fibers is also effective to coagulate the butadiene-acrylonitrile copolymer resin in the aqueous dispersion thereof the acid applied serves the double purpose of effecting the coagulation of the resin and modifying the cutose coating for the fibers so as to act as a surface cement for the coagulated resin.

Aqueous dispersions of butadiene acrylonitrile copolymer resin used in the manufacture of the wiping cloth of this invention are well known. Generally, such dispersions contain about 40% to 50% of the butadiene-acrylonitrile copolymer, although other concentrations of the copolymer may be used. Such dispersions have liquid characteristics, being similar in this regard to a latex which contains natural rubber instead of the butadiene-acrylonitrile copolymer. A number of different concerns produce aqueous dispersions of butadiene-acrylonitrile copolymers. Such dispersions are sold by the Goodyear Tire & Rubber Company of Akron, Ohio, under the trademark "Chemigum" and that type which is further identified as Latex Type 200, has been found to result in an especially satisfactory product. Similar dispersions are produced by the B. F. Goodrich Company of Cleveland, Ohio under the trademark "Hycar"; and the Hycar dispersion which is further identified as Type OR-25 has been found to possess very desirable characteristics for use according to this invention. There are other similar dispersions of butadiene-acrylonitrile copolymers which are manufactured by other concerns.

The aqueous dispersion of butadiene-acrylonitrile copolymer may be applied to the fibrous sheet-like body containing the gray cotton fibers in any suitable way. However, it is desirable that the dispersion be distributed through the fibrous structure of the sheet so as to occur in the form of coatings for the individual fibers as distinguished from forming a more or less continuous film on the surface of the sheet material. It has been found that if the sheet material having the dispersion applied thereto is pressed between squeeze rolls which subject the sheet to light pressure, the dispersion becomes distributed on and among the fibers in preferred relation thereto. However, the dispersion may be applied to the sheet in any other suitable way so that the sheet will take up sufficient of the dispersion in order to provide the amount of butadiene-acrylonitrile copolymer desired in the finished sheet.

After the aqueous dispersion of the butadiene-acrylonitrile copolymer has been caused to impregnate the fibrous sheet comprising the unspun gray cotton fibers the resultant sheet, while still wet with the impregnated dispersion, has the solution of mineral acid applied thereto as to permeate the fibrous sheet and subject the cutose coating of the cotton fibers to the action of the acid. As above mentioned, the acid as so applied also serves to coagulate the butadiene-acrylonitrile copolymer on and among the unspun fibers comprised in the sheet.

The acid treating step may be performed in any desired way. For example, the fibrous sheet after having been impregnated with the dispersion of butadiene-acrylonitrile copolymer may be contacted with a bath consisting of an aqueous solution of the mineral acid. Alternatively, the mineral acid solution may be applied to the sheet which has been impregnated with butadiene-acrylonitrile copolymer dispersion by transfer or by spray application. In any such case, it is desirable, as by passing the sheet over or between rolls, to cause the acid solution to permeate the sheet so as to thoroughly contact the cutose coating of the cotton fibers. It is also preferable to subject the sheet to light squeezing so as to remove excess liquid.

After the acid treating step has been completed the sheet may be immediately dried and then will be ready for use. Preferably, before the sheet is dried the sheet is subjected to a rinse with water so as to wash out a substantial amount of the acid or acid salt used in the acid solution and any other soluble by-products of the reaction. Normally, the concentration of the acid which is employed is such that even though the fabric is not subjected to the rinsing step the retained acid and other by-products of the reaction do not detract from the utility of the fabric and do not result in degradation of the cotton fiber. However, if the acid used is at such a concentration as to cause gradual degradation of the fibers it may be desirable to subject them to the rinsing step. Moreover, by the use of a rinsing step the possibility of any adverse effect either on the fiber comprised in the wiping cloth or on a surface which may be subsequently wiped with the wiping cloth may be minimized.

The acid used in the acid treating step has a modifying effect on the cutose coating of the cotton fibers so as to provide a surface cement on the fibers which greatly promotes the adhesion of the butadiene-acrylonitrile copolymer to the fibers as disposed on and among the fibers as a result of coagulation in situ. This is believed to be due to the fact that there is an interaction between the acid used in the acid treating step and the insoluble pectose in the cutose coating whereby either directly or due to possible catalytic action all or a substantial amount of the pectose becomes converted to soluble pectin. The cutose coating as thus modified by the conversion of the pectose therein to pectin appears to have a special adhesive affinity for the butadiene-acrylonitrile copolymer. The modified cutose coating remains firmly adherent to the body portion of the cotton fibers and in effect affords a priming coat of surface cement for causing the butadiene-acrylonitrile copolymer as disposed on and among the cotton fibers to adhere strongly to the fibers. In any case regardless of theory it has been found that if the foregoing steps are carried out using cotton fibers which have been subjected to conventional chemical treatments for cleaning them so as to remove the normally unwanted cutose coating the resulting product is not suitable for use as an oil wiping cloth due principally to the fact that the material in such case is lacking in sufficient strength to permit such use thereof.

By the acid modification of the cutose coating of the cotton fibers according to this invention, the bond of the butadiene acrylonitrile resin with the fibers can be made such that upon increasing tension imposed on the fabric to the point of rupture, the fibers themselves become ruptured rather than merely pulling free without breaking.

The action of the applied acid on the cutose coating of the cotton fibers appears to be promoted by mild heating. Thus, when the fabric is dried by passage over heated drying drums or is otherwise similarly heated the fabric has substantially greater strength than if the fabric was not warmed prior to completion of the drying. While the acid used in the acid treating step serves to coagulate the butadiene-acrylonitrile copolymer in the dispersion previously caused to impregnate the fabric, the acid solution applied reaches the cutose coating of the cotton

fibers with the result that the butadiene-acrylonitrile copolymer becomes deposited on and among the cotton fibers so that the copolymer contacts and adheres to the cutose coating which has been modified by the action of the acid in solubilizing at least a portion of the pectose in the cutose coating.

Any strong mineral acid or acid salt of a strong mineral acid may be used in the acid treating step. The mineral acids which are preferably used are hydrochloric and sulfuric acids. However, nitric acid also may be used. Acid salts of strong mineral acids may also be used and the use of such acid salts is preferable from the standpoint that such acid salts usually can be more readily handled than the free mineral acids. Acid salts which are especially desirable are ammonium sulfate, magnesium sulfate, sodium bisulfate and alum. Whether a solution of a free mineral acid is used or a solution of an acid salt is used the solution in either case is referred to herein and in the claims as a solution of a mineral acid for when an acid salt is used the acid salt becomes ionized so that the resultant solution contains the ions which likewise are present when a free mineral acid is used.

In order to obtain the desired modification of the cutose coating of the fiber, the mineral acid, whether in the free acid form or in the acid salt form, should be a strong acid, i. e., one which becomes highly dissociated in aqueous solution. The acids and acid salts above exemplified are of this type and are to be contrasted with a relatively weak acid such as phosphoric acid, trichloroacetic acid, acetic acid, and the like. The strong mineral acids effective for modifying the cutose coating of the cotton fibers have a dissociation constant greater than 2×10^{-1} . When the mineral acid is used in the free acid condition the concentration required to modify the cutose coating of the gray cotton fibers is somewhat greater than is the case when the mineral acid is employed in the acid salt form. Thus, in the case of sulfuric acid or nitric acid, a concentration of at least about 5% by weight is required in order to obtain the desired modifying effect on the cutose coating. To obtain a similar modifying effect a concentration of at least about 2.5% is required in the case of nitric acid. In the case of an acid salt such as alum



or Epsom salts ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$) all that is required is at least about 1% concentration.

In the interest of economy it is usually desirable to hold down the concentration of the acid solution to a concentration only slightly in excess of the minimum concentration for effecting the desired modification of the cutose coating and the desired coagulation of butadiene-acrylonitrile copolymer on and among the fibers. However, greater concentrations may be employed. In the case of the acid salts concentrations up to the limit of solubility can be used without injury to the fibers or deleterious effect other than the retention of an undue amount of salt and unnecessarily adding to the cost of the fabric. In the case of the free acid, if the concentration is too high there is the likelihood of tendering the cotton fiber although the essential effect of the acid in coagulating the dispersion of the butadiene-acrylonitrile copolymer and in modifying the cutose coating would essentially be the same as has been hereinabove described. Moreover, when the concentration of free acid is relatively high the butadiene-acrylonitrile copolymer tends to become coagulated in a more tacky condition than is the case when a more dilute solution is employed and such tackiness, if excessive, may result in rendering the sheet somewhat difficult to handle during and immediately after the acid treating step. However, the effect of relatively high concentration of acid in either of the respects above mentioned can be minimized by the above mentioned rinsing step which serves

to remove excess acid from the fabric, thus minimizing the possibility of tendering the cotton and reducing the tackiness of the butadiene-acrylonitrile copolymer as originally deposited on and among the fibers. Moreover, if the butadiene-acrylonitrile copolymer resin which is caused to become coagulated on and among the fibers is in a condition of limited tackiness such that the sheet can be readily handled, such initial tackiness of the coagulated copolymer disappears as a result of the drying operation, preferably when the drying is preceded by a rinsing step, with the result that the finished product is non-tacky and has the feel of a soft chamois.

As a result of the above described operations the butadiene-acrylonitrile copolymer resin becomes deposited on the cotton fibers in such a way as to provide in the finished sheet a high degree of porosity and absorptiveness for oil. For most oil wiping cloth purposes the amount of resin solids which is coagulated on and among the cotton fibers is such that there are about 50 to 55 parts by weight of the resin solids per 100 parts of fiber. This corresponds to approximately 30% to 35% of the resin solids that is comprised in the finished wiping cloth. In order to afford sufficient body and strength the amount of resin solids should be at least about 40 parts of the resin solids per 100 parts by weight of the fiber. This corresponds to about 28% of the resin solids comprised in the finished wiping cloth. It usually is not desirable to reduce the amount of resin solids in the oil wiping cloth below about 25% by weight.

Notwithstanding the presence of such a substantial amount of resin solids comprised in the finished wiping cloth, the wiping cloth has a remarkable capacity for absorbing oil. For example, a wiping cloth wherein the resin solids constitute about 35% by weight thereof is such that 100 grams thereof will absorb and retain without dripping up to about 200 grams of oil. This high degree of absorptiveness for oil displayed by the wiping cloth of this invention may be compared with that of conventional fabrics which have heretofore been used for oil wiping cloth purposes. Thus, the best grade of wiping cloth previously used for the purpose is such that 100 grams thereof will not absorb without dripping more than about 150 grams of the same oil that was used in testing the absorptiveness of the oil wiping cloth fabric of this invention with the results hereinabove mentioned. It is thus seen that an oil wiping cloth can be made according to this invention which is substantially more effective for its intended purpose than the best grade of conventional wiping cloths.

The absorptiveness of the wiping cloth of this invention for mineral oils and other similar materials appears to be only slightly affected by the amount of the butadiene-acrylonitrile copolymer that is deposited on the fibers. This was demonstrated by preparing an oil wiping cloth fabric according to this invention containing about 30% to 35% of the resin solids and then testing the fabric for oil absorptiveness as above mentioned. The fabric was then subjected to the operations of impregnation with a dispersion of the butadiene-acrylonitrile copolymer resin followed by the acid treating step so as to deposit an additional amount of resin solids on the fibers for providing in the finished fabric about 100 parts by weight of the resin solids for each 100 parts of the cotton fibers. While one might expect that the additional resin solids would tend to fill up the interstices of the fabric and thereby impair its absorptiveness this was not found to be the case, for the fabric was found to exhibit the same high degree of absorptiveness notwithstanding the additional amount of resin solids contained therein. It is believed to be the case that even though the fibers as such are thoroughly coated with the butadiene-acrylonitrile resin, the resin becomes deposited so that as carried on and among the surfaces of the cotton fibers the resulting fabric exhibits a high degree

of absorptiveness for mineral oil. In certain respects the finished fabric is in the nature of a sheet-like oil sponge which has a fiber matrix.

For most purposes it is not necessary that the finished fabric contain more than about 30% to 35% by weight of the resin solids, for ample strength for most purposes in combination with a very high degree of absorptiveness can thereby be afforded. Upon increasing the proportion of resin solids contained in the finished product the strength of the finished product can be increased as well as its resistance to abrasion and capacity to withstand long usage. Generally the amount of resin solids does not exceed about 50% of the weight of the fabric. Expressed as a ratio, the ratio of resin solids to fiber in the finished fabric is generally from about .4 to 1 to 1 to 1.

The finished fabric not only displays a high degree of absorptiveness for oil as mentioned above but also exhibits in high degree those properties which are desirable in an oil wiping cloth fabric. One of these properties is the very important one that the fabric is not adversely affected as the result of prolonged contact with mineral oils absorbed thereby or prolonged contact with solvents such as naphtha or gasoline. For example, the wiping cloth fabric of this invention has been tested by immersing it in gasoline for 24 hours and then permitting the gasoline to evaporate so as to restore the fabric to a dry condition. After such treatment no measurable change in dimensions was found to have occurred in any direction of the fabric. Moreover, the fabric retained all of its original properties as regards tensile strength, as regards the feel of the fabric and as regards the capacity of the fabric to absorb oil. Such resistance to solvents is important in an oil wiping cloth fabric for, as above mentioned, wiping cloth fabrics are frequently kept immersed in a container of gasoline or kerosene so that the wiping cloth fabric may, to some extent, be cleaned by such immersion and then wrung out for use in wiping machinery. Moreover, such resistance to solvents is important if it should be desired to subject the wiping cloth fabric of this invention to any of the "laundering" treatments conventionally used for cleaning ordinary oil wiping cloths which employ a suitable solvent such as gasoline or kerosene.

While the wiping cloth fabric of this invention can be subjected to laundering using a solvent such as gasoline or kerosene for the purpose, the cost of the wiping cloth fabric of this invention is so low that the wiping cloths made therefrom can be thrown away after having been used for wiping cloth purposes. As above mentioned the cost for laundering conventional wiping cloth fabric is about 5 cents per 200 square inches. The wiping cloth material of this invention is such that it can be purchased for wiping cloth purposes at a corresponding cost, namely, about 5 cents per 200 square inches of the material. It is apparent, therefore, that the wiping cloth fabric of this invention is much more economical than conventional fabrics used for wiping cloth purposes, for the initial cost is much lower and the initial cost is so low that the wiping cloth can be thrown away after use. Also there is no necessity for installing special equipment for reconditioning used cloths.

Another advantage of this invention is that the oil wiping cloth is inherently such as to be lint free. The individual fibers of the unspun gray cotton fiber fabric become coated with the butadiene-acrylonitrile copolymer resin that is deposited on and among them, and there is no possibility of the occurrence of lint. In connection with conventional wiping cloth fabrics, those which are substantially lint free demand premium prices and such freedom from lint can be afforded according to this invention at a much lower cost.

For purpose of exemplification, a typical example of the practice of this invention will be described in connection with the accompanying drawing which shows sche-

matically and in side elevation one type of equipment which is adapted for producing the wiping cloth fabric of this invention on a continuous basis.

For purposes of illustration the fabric employed may be a conventional carded cotton sheet about 36 inches wide and weighing about 1 pound for 10 yards of the sheet. As above mentioned the carded cotton fibers are in the raw state and carry on the surface thereof the cutose coating of the natural fiber. This carded cotton sheet 1 is taken from the supply roll 2 over guide rolls 3 and 4 to the nip between the squeeze rolls 5. An aqueous dispersion of butadiene-acrylonitrile copolymer resin such as the aforesaid "Chemigum" Latex Type 200 which contains about 45% by weight of resin solids, i. e., butadiene-acrylonitrile copolymerized in the relative proportion, by weight, of about 67% and about 33%, respectively, is applied to the rolls 5 throughout the length thereof as by the use of the pipes 6 to which the dispersion is supplied from a suitable source not shown and to which a series of nozzles is attached that distribute the dispersion on the surface of the rolls 5 uniformly along the length thereof. The dispersion is carried by the rotating rolls to the nip between them where it is absorbed into the carded cotton sheet 1. In order to facilitate the smooth laying of the carded cotton sheet between the nip of the rolls 5 the sheet is preferably contacted with one of the rolls slightly in advance of the nip as shown. Since the carded cotton sheet is absorptive the dispersion is immediately absorbed into the sheet. The setting of the squeeze rolls 5 is such that the weight of the aqueous dispersion retained by the sheet is slightly in excess of the weight of the cotton fiber. This will result in the ultimate deposition on the cotton fibers of about 50 parts by weight of the resin solids per 100 parts by weight of the cotton fibers on the dry basis. Any excess of the dispersion which is not retained by the carded cotton sheet at the nip between the rolls 5 is permitted to flow laterally toward the ends of the rolls so that it may be collected in the drip pan 7 and returned to the source of supply. In order to facilitate the stripping of the impregnated carded cotton sheet from the rolls 5 and in order to clear the drip pan 7 the impregnated sheet is carried on the surface of one of the rolls as shown and is stripped therefrom by the stripping roll 8.

By the foregoing operation the fabric is caused to be impregnated throughout with the dispersion of the butadiene-acrylonitrile copolymer and the dispersion is caused to become distributed in the form of coatings for the individual fibers so that the sheet is moistened throughout with the dispersion without substantial film formation at the surfaces of the sheet.

After the sheet has been impregnated with the aqueous dispersion of butadiene-acrylonitrile copolymer it is immediately passed to the acid treating step which can advantageously use equipment generally similar to that employed in connection with the initial impregnation step. The impregnated fabric may be passed between squeeze rolls 9 to the surface of which a solution of a mineral acid is applied as by uniform spraying from the pipes 10. For example, the mineral acid solution employed may be an alum solution of about 5% to about 10% concentration. This solution is applied to the impregnated fiber sheet so as to become permeated therethrough as by passing the sheet between the nip of the squeeze rolls 9. The acid solution is thereby caused to come in contact with the cutose coating of the fibers and serves to modify the cutose coating while at the same time the butadiene-acrylonitrile copolymer is caused to coagulate on and among the fibers. To facilitate the laying in of the impregnated sheet and the stripping of the acid treated sheet, the sheet is contacted with one of the rolls 9 substantially in advance of the nip between these rolls and, after having been carried on the surface of one of these rolls, is stripped therefrom using the stripping roll 11.

Excess liquid is free to flow down from the ends of the rolls 9 so as to be collected in the drip pan 12.

If the fabric is to be rinsed with water this can be accomplished by passing the impregnated and acid treated sheet between the squeeze rolls 13 to which rinsing water is supplied by spraying from the pipes 14. The rinsing water is worked into the sheet as the sheet is squeezed between the squeeze rolls 13 and the excess flows into the drip pan 15. To facilitate laying in of the sheet the impregnated and acid treated sheet is contacted with the rolls 13 in advance of the nip and is carried on the surface of one of the rolls until stripped therefrom using the stripping roll 16.

By the foregoing operations the chemical treatment of the sheet has been completed and it remains to dry the sheet. The treated sheet in the wet condition may be carried to suitable drying equipment as by the use of the upper run of a continuous slat-type conveyor 17. The drying equipment used may comprise a plurality of heated drying drums 18 which may be heated in any suitable way as by the use of hollow drums to the interior of which steam is supplied. The drums 18 are preferably enclosed in a compartment 19 through which heated air or other gaseous medium can be circulated so as to carry out the moisture. As above mentioned the adhesion of the deposited coagulated butadiene-acrylonitrile copolymer to the fiber surfaces is promoted by the action of the acid on the cutose coating of the cotton fibers. Such action continues during the drying of the fabric and is accelerated by the heat of the drying drums. After the drying step the fabric may be removed from the drying enclosure, as by passage over the rolls 20, 21 and 22, after which it may be wound up into the roll 23. If desired the fabric can be slit into desired widths by suitable knives (not shown) so as to provide a plurality of rolls of desired width for oil wiping cloth purposes, suitable lengths merely being cut from the rolls. The oil wiping cloth fabric is in its finished condition ready for use as soon as the drying step has been completed.

While a specific form of equipment has been shown and described in connection with the drawings it is apparent that any other suitable equipment may be used. For example, in the acid treating and rinsing steps immersion in an acid bath and in a rinsing bath has been used in the production of an oil wiping cloth fabric according to this invention.

While the wiping cloth fabric of this invention is ordinarily made from a sheet consisting of unspun cotton fibers which carry on the surface thereof at least a substantial amount of the cutose coating of the natural fiber the principles of this invention would also be employed if the sheet material used were to contain a diluent material such as paper making wood fibers so long as the cotton fibers carrying the cutose coating are disposed in intimately contacting relation in order that in the finished sheet the coagulated butadiene-acrylonitrile copolymer will become adherent to the acid modified cutose coating of the cotton fibers and bond them together. Ordinarily it is desirable that a fibrous sheet material be used which consists at least in major proportion of cotton fibers carrying a substantial amount of the cutose coating of the natural fibers.

I claim:

1. A method of making a fabric that is absorbent to liquid hydrocarbons comprising the steps of impregnating a bibulous sheet of loose, unspun, natural cotton fibers carrying a substantial amount of the naturally occurring cutose coating, containing pectose, with a butadiene-acrylonitrile synthetic rubber latex, applying to said impregnated sheet in the presence of said latex a strong mineral acid having a dissociation constant greater than about 2×10^{-1} capable of converting pectose in said cutose coating to pectin by reaction therewith and capable of coagulating said latex in adherent relation to said cutose coating containing said pectin, the duration of

contact with said acid being sufficient to obtain the aforesaid results and less than that which results in substantial tendering of said fibers, and hereafter drying the impregnated sheet.

2. Method of claim 1, wherein said sheet is rinsed with water prior to the drying step.

3. A method of making a fabric that is absorbent to liquid hydrocarbons being thereby adapted for use as a wiping cloth which comprises the steps of impregnating a bibulous sheet of loose, unspun, natural cotton fibers having thereon the cutose coating of the natural cotton fibers, containing pectose, with a butadiene-acrylonitrile synthetic rubber latex, simultaneously reacting the pectose contained in said cutose coating with a strong mineral acid capable of converting at least some of the pectose to pectin and capable of coagulating said latex on and among said fibers as a coating that overlays the resulting pectin-containing cutose coating of said cotton fibers, applying to the sheet in the presence of said latex an aqueous solution of said strong mineral acid having a dissociation constant greater than 2×10^{-1} and blending with it said latex throughout said sheet, the duration of contact with said acid being sufficient to obtain the aforesaid results and less than that which results in substantial tendering of said fibers, and thereafter heating and drying the impregnated sheet, the ratio by weight to said fibers of said butadiene-acrylonitrile synthetic rubber being between about 0.4:1 and 1:1.

4. The method of claim 3 wherein said latex of butadiene-acrylonitrile synthetic rubber is impregnated into said sheet by passing said sheet between a pair of rotating rolls in pressure contact with said sheet, said latex being applied to said sheet immediately in advance of the nip between said rolls.

5. A method of making a fabric that is absorbent to liquid hydrocarbons being thereby adapted for use as a wiping cloth which comprises the steps of impregnating a bibulous sheet of loose, unspun, natural cotton fibers having thereon the cutose coating of the natural cotton fibers, containing pectose, with a butadiene-acrylonitrile synthetic rubber latex by distributing the latex among the fibers as a coating upon individual fibers and removing excess latex by pressing the sheet between rotating rolls in pressure contact with said sheet, thereby leaving the sheet in a moist, porous, absorptive condition, then applying to said sheet a solution of a strong mineral acid having a dissociation constant greater than about 2×10^{-1} capable of converting pectose in said cutose coating to pectin and capable of coagulating said latex, pressing the sheet between rotating rollers and thereby subjecting said cutose coated fibers to the action of said mineral acid and causing the synthetic rubber in the latex to be coagulated on and among the fibers in contact with said cutose coating, the acid concentration and the duration of its contact with said fibers being such that said fibers are not substantially tendered by said acid, and thereafter drying the sheet while it is maintained at a superatmospheric temperature.

6. The method of claim 5 wherein said fiber sheet is impregnated with said latex by passing the sheet between squeeze rolls to which said latex is applied in advance of contact of the roll with the sheet whereby said latex flows into said sheet, in advance of the nip between said rolls and the sheet is carried on one of said rolls substantially beyond the nip therebetween prior to being stripped therefrom.

7. A wiping cloth fabric which is absorbent to liquid hydrocarbons, and which comprises unspun fibers disposed in sheet form, a major proportion of said fibers being natural cotton fibers having adherent thereto in a coating, pectin derived from the naturally occurring cutose of said cotton fibers, and coagulated, dried butadiene-acrylonitrile synthetic rubber distributed on and among said cotton fibers as a coating therefor in adherent relation to said pectin, said fibers being bonded together

11

by said coating in porous absorptive relation in said fabric.

8. The fabric of claim 7 which contains at least about 25% by weight of said butadiene-acrylonitrile synthetic rubber.

9. A fabric that is absorbent to liquid hydrocarbons comprising unspun fibers disposed in sheet form, a major proportion of said fibers being natural cotton fibers having adherent thereto in a coating, pectin derived from the naturally occurring cutose of said cotton fibers, and coagulated, dried butadiene-acrylonitrile synthetic rubber distributed on and among said cotton fibers as a coating therefor in adherent relation to said pectin, said fibers being bonded together by said coating in porous, absorp-

12

tive relation in said fabric, the ratio by weight of said butadiene-acrylonitrile synthetic rubber to the fibers in said sheet being between about 0.4:1 and 1:1.

References Cited in the file of this patent

UNITED STATES PATENTS

1,360,224	Kashitani	Nov. 23, 1920
1,465,093	Respass	Aug. 14, 1923
1,616,062	Novotny et al.	Feb. 1, 1927
2,351,498	Fowler	June 13, 1944

FOREIGN PATENTS

205,157	Great Britain	Oct. 5, 1923
---------	---------------	--------------

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,863,715

December 9, 1958

Maurice A. Goldman

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 27, before "fibers" insert -- cotton --; column 10, line 3, for "hereafter" read -- thereafter --; line 40, for "butadiene-" read -- butadiene- --.

Signed and sealed this 9th day of June 1959.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents