Nov. 15, 1955 W. C. ROSS ET AL 2,723,932

TEXTILE PRINT WASH BLANKET AND METHOD OF MAKING SAME

Filed March 13, 1951 2 Sheets-Sheet 1

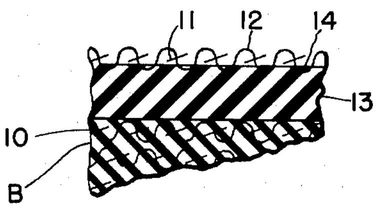

FIG 1

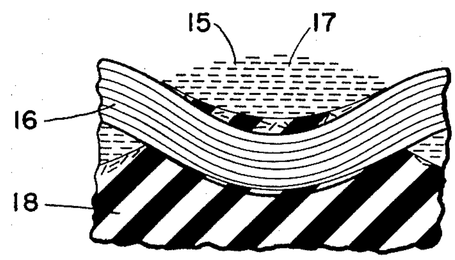

FIG 2

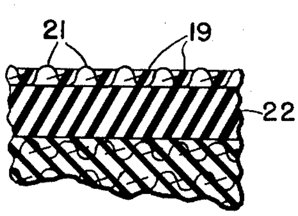

FIG 3

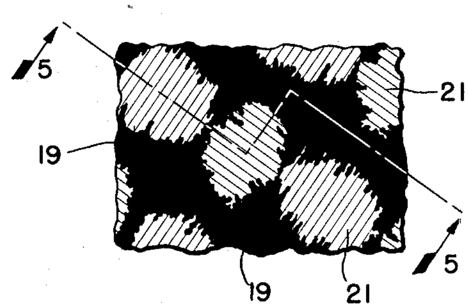

FIG 4

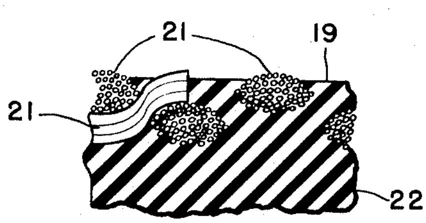

FIG 5

Inventor
William C. Ross
Alec W. Niconchuk
By Theodore C. Browne
Attorney

Nov. 15, 1955 W. C. ROSS ET AL 2,723,932

TEXTILE PRINT WASH BLANKET AND METHOD OF MAKING SAME

Filed March 13, 1951 2 Sheets-Sheet 2

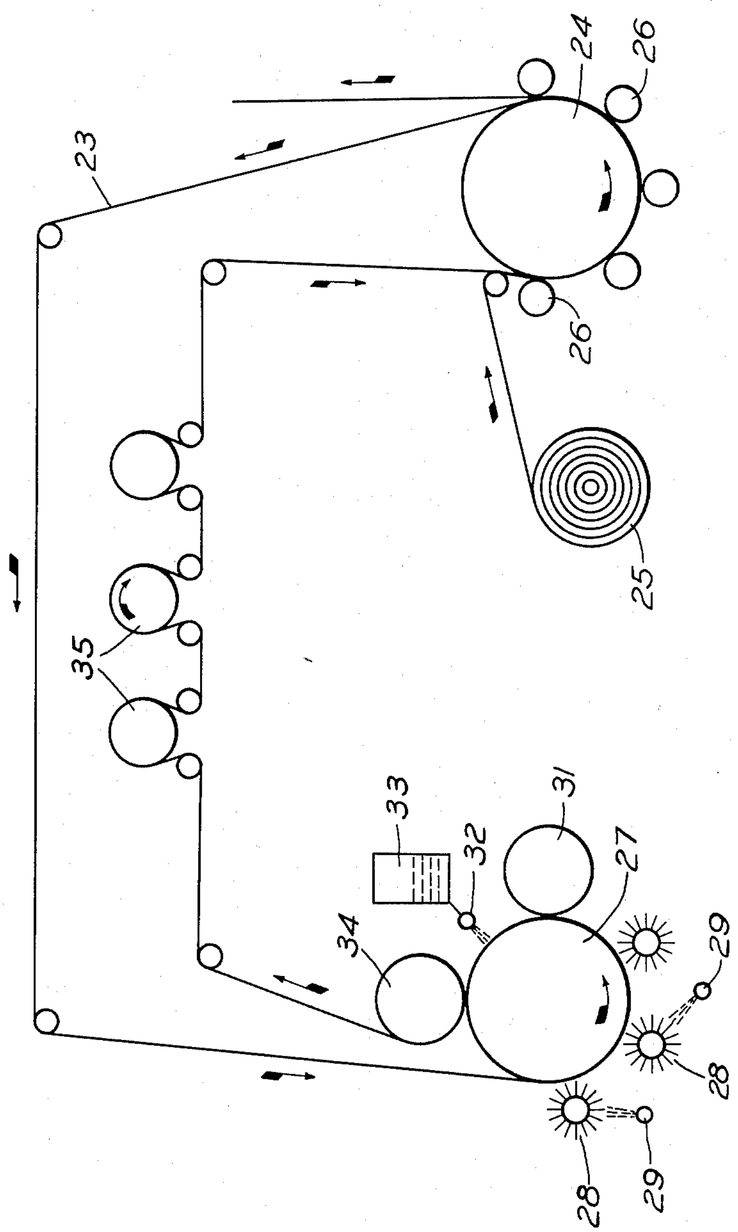

FIG 6

Inventor
William C. Ross
Alec W. Niconchuk
By Theodore C. Browne
Attorney

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TEXTILE PRINT WASH BLANKET AND METHOD OF MAKING SAME

William C. Ross, Winchester, and Alec W. Niconchuk, Peabody, Mass., assignors to W. R. Grace & Co., New York, N. Y., a corporation of Connecticut

Application March 13, 1951, Serial No. 215,358

10 Claims. (Cl. 154—54.5)

It is implicit in any textile printing process that more color than just that amount necessary to print the design must be used. Some color is driven through the interstices of the textile as the textile is being printed. Also, since a long strand of cloth running over rolls has a tendency to weave slightly from side to side, it is necessary to engrave the pattern on the color rolls somewhat wider than the width of the cloth if a full width design is to be printed. All this color will build up on the impression cylinder or bed roll of the textile printing range if some means is not provided to take the excess away. Therefore, since the early beginnings of the process of printing textiles by machinery, a necessary element has been the "greige," a long strand of cloth placed directly beneath the cloth which is to be printed. The greige or the "backgray," as it is now universally called in the United States, receives color driven through the printed textile and receives the full amount of color emptied from those engraved areas which extend beyond the selvage of the goods. Backgrays are usually as long as the piece of goods being printed. They are removed periodically from the printing range, color is discharged, the backgray is washed and then returned to the printing range. Washing progressively weakens the backgray fabric. Ultimately the backgray becomes scrimped, torn and unusable.

The yardage of printed goods that may be printed on one yard of backgray varies enormously. Depending upon the pattern, weave and type of work that a printing establishment handles, the life of a backgray may range anywhere from a very small multiple of the yards of goods which were printed to possibly 200 times the yardage of the printed goods. In all cases, however, the initial cost of the backgray and the cost of maintaining it add considerably to the cost of the printing operation. However, the most serious difficulty associated with the use of backgrays occurs during cloth shortages, as during a national emergency, when many mills find it hard to obtain backgray cloth in sufficient amounts.

A much later method of printing textiles has eliminated the need of a backgray by replacing the heavy felt blanket which, in the original process, was always run over the impression cylinder and beneath the backgray cloth, with a smooth faced, rubber covered and rubber impregnated blanket. These so-called "wash blankets" are water and color impermeable and therefore can be washed and dried quickly in a continuous operation. They are put on the printing machine in the form of a long loop or endless belt, with the goods to be printed lying directly upon the wash blanket as they travel through the printing station. The blanket then passes through a continuous washer where the color-smeared blanket is scrubbed by rotary brushes and rinsed by water sprays; then it passes through a continuous drier. The blanket returns to the printing station in a clean, color receptive condition. The wash blanket process has worked well on a limited number of patterns where the design is light and the amount of color de-

posited on the blanket is small. A smooth faced blanket does not work well when the amount of color deposited on the blanket is considerable, since the smooth face of rubber has very little capacity to pick up color.

In the intervening years, the rubber surface of wash blankets has been modified in various ways to increase the capacity of rubber faced blankets to carry color. Nevertheless, although wash blankets are widely used, there are still many designs and many fabrics which must be printed by the use of a backgray.

The present invention is concerned with an improvement in wash blankets which extends their range of usefulness to an extraordinary degree. In fact, on the printing machine on which these blankets were tested and on which a large variety of fabrics, designs and colors were printed, no design or fabric tested required the use of a backgray.

In an attempt to increase the tensile strength and life of a wash blanket by various constructional changes, it was noticed that when a fabric formed from a linear, polymeric, high tensile strength synthetic textile yarn having high fiber elasticity is bedded in a cured elastic compression layer of rubber with the surface of the fabric exposed, the dry fabric picked up, absorbed, and held textile coloring pastes. Then the extraordinary fact was noticed that, if the fabric surface which had been colored was flooded with water and then roll squeezed, the color was forced or flushed out of the interfilamentary spaces of the yarn, leaving the fabric clean and color free. The water appeared preferentially to displace the color from the surface of the individual filaments in the yarn. Then, when the blanket was squeezed, the synthetic filaments, being free to move somewhat because they have high fiber elasticity and because the yarns are bedded in an elastically distortable compression layer ejected the water-suspended color paste even from the innermost interfilamentary capillaries of the yarn.

This phenomenon, which is in violent contrast to the performance of natural fibers, which under the same conditions trap and hold color particles in the interfilamentary spaces of the yarns, was so contrary to past experience that it was thoroughly investigated. That investigation finally showed that the capacity of a yarn to expel color from its interfilamentary spaces is possessed by a number of the new synthetic textile fibers. Fabrics formed from yarns of such fibers are useful as the surface layer of textile print blankets provided

(1) that the individual filaments making up the yarn possess the following characteristics:

(*a*) the filament is a synthetic, linear high polymer;
(*b*) the polymer is crystalline;
(*c*) the polymer is cold-drawn to its final filamentary dimensions;
(*d*) the crystals of the polymer are preferentially oriented along the fiber axis as a result of cold-drawing;
(*e*) the polymer possesses low to negligible water absorption;
(*f*) the softening point of the polymer is above the temperature used for curing the rubber and above the boiling point of water;
(*g*) the individual filaments possess elasticity and exhibit quite rapid elastic recovery;
(*h*) the yarn made from the filament also possesses elastic properties (although the elasticity of the yarn as contrasted with the high elasticity demanded of the filament may be in the same order as that possessed by some yarns spun from natural textile fibers); and

(2) that movement of the individual fibers in the yarn under a rolling pressure is permitted by bedding the yarn in an elastic, distortable substance (for example, the rubber cushioning layer).

When a textile print blanket having a working surface fabricated from materials possessing the above characteristics and bedded in a cured elastic cushioning layer of rubber is placed on a wash blanket printing range, the following occurrences take place:

(1) The excess color paste emptied from the engravings is deposited on the surface of the blanket while the blanket and superposed goods being printed pass under the engraved color carrying roll.

(2) As soon as the pressure is released, which occurs just as soon as the goods and the blanket advance beyond the pinch point of the bed roll and the engraved color carrying roll, a considerable amount of this deposited color paste is drawn into the interfilamentary capillaries of the bedded textile facing of the blanket.

(3) When the color-smeared blanket reaches the washing station and is flooded with water as the preliminary washing step, water saturates these interfilamentary spaces.

(4) As the blanket is squeezed between drying rolls in the final washing step, the interfilamentary voids collapse and the water is forced out, carrying with it the color which has entered the yarn. The color which is expelled from the working layer of the blanket may be seen coming off as a scum on the sheet of water which flows backward along the blanket just in advance of the pinch point of the squeeze rolls.

The elastic cushioning layer of rubber in which the fabric surface layer is bedded takes an active part in the series of happenings which have just been described. First, the layer permits a relative movement of the individual filaments of the yarn when a rolling pressure is applied, and second, its exerts an outwardly directed thrust on the yarn which forces the liquid from the lowermost capillary areas.

Why color particles do not imbed themselves in my preferred fabrics is not readily explainable. The individual yarns of these fabrics are made up of many fine filaments, and one would expect that under the heavy pressures of printing some color would be forced into the interfilamentary spaces of the yarns and would be trapped there. Both cotton backgrays and woolen blankets, when repeatedly run through a printing range, progressively harden and crack from this cause alone, apparently because the fibers form a filter mat which holds back the color. For some reason, the fibers utilized in our invention do not form a filter mat and the color does not build up in their interfilamentary space to a deleterious degree.

The performance of such textiles as the working face of the blanket is surprising in another respect. They do not crack, tend to separate or fray under the enormous pressures of the textile printing process. A cotton textile working face on a textile print blanket is progressively pulverized by the rolling compressional wave. A wool face rapidly felts, then splits into a multitude of pieces as the felt becomes boardy. But although the yarns made from the preferentially oriented synthetic fibers described may possess an extensibility at the break point in the same order of magnitude as that possessed by the cotton and the woolen yarns, nevertheless, fabrics made from these substances do not break, fray or tear under the forces which they experience, but withstand the working stress of the rolling wave apparently indefinitely, for blankets made according to this invention have been subjected to a rolling pressure stress for several million cycles without developing cracks and without shredding.

While the blanket is usually passed through squeeze rolls as the final step of the washing operation, further drying of the blanket is normally necessary. This is accomplished by carrying the blanket around the periphery of a few textile drying cans which are heated in the usual manner. By the time any given area of the blanket returns to the printing station, the original dry condition of the yarn has been restored.

We have found that the yarns formed from the filaments described above possess the following physical characteristics when bedded in an elastic cushioning layer as the top surface of a textile print blanket:

First, they will accept color paste, drawing a portion of the color paste into their interfilamentary capillary channels if the surface and the body of the yarn are dry.

Second, they preferentially absorb water and permit their capillary volume to be flooded with water.

Third, they eject the color paste from their capillaries when the capillary dimensions are made smaller.

Fourth, they restore themselves to their original condition as the working layer dries out.

Fifth, the restoration of the yarn to its original condition takes place with sufficient rapidity so that, when the area again reaches the printing station, the entire process may be repeated over and over again.

The speed at which a textile range equipped with such a blanket may be run is apparently set by the speed at which finishing operations may be conducted on the cloth. Some designs cannot be developed, dried and finished as fast as others. Top speed so far reported is 192 yards a minute for a 28-yard blanket, and at this speed a high quality print which was satisfactory in every respect was produced. In no case, to date, has the top speed of a textile range been limited by blanket condition.

Such a blanket, although it may be washed and dried as rapidly as any of the wash blankets now in use, is sharply contrasted from all previous wash blankets which, for reasons which have been explained, have always been made as impervious as possible. Although the surface of these previous blankets may have contained pits and channels to provide mechanical storage areas for color, the color always remained above the actual surface of the blanket. Since all of the color must remain above the surface of an impervious blanket, the color will be squeezed out of place if the color rolls press on the blanket too heavily. The printer, in using a wash blanket, consequently, found that he had to use great care in the "setting" of the individual color rolls if he was to avoid edge and body flushing of the colors in the design. The adjustments were critical and were selective in the patterns which could be run.

Our improved blankets, on the other hand, absorb color into their working face. They may hold some color in whatever mechanical storage areas may be formed by the crossed yarns, but primarily they depend for their color holding capacity upon the capillary activity of an active surface layer. Because the color is held securely within the surface layer, the new blankets are insensitive to edge and body flushing throughout much wider ranges of pressure than any wash blanket previously known to us. In consequence, a printer can produce high quality unflushed patterns without spending nearly as much time in the "setting" of the individual color rolls as was necessary in the past.

Basically our improved textile blanket consists of a color absorptive working face adhered to an elastic cushioning layer which in turn is secured to a body sandwich of several plies of duck coated with a rubbery interply cement. The individual plies of the print blanket structure are respectively spliced according to any manner known in the art to form an endless belt, the splice in each ply being preferably offset from that of any other ply to increase the tensile strength of the blanket. The entire assembly is cured under heat and pressure preferably in a belting press to form a unitary textile print blanket structure.

As the specific examples at the end of the specification will show, the preferred means which we use to prevent the penetration of the rubber through the color absorptive working surface is to cause the elastic cushioning layer of rubber to set up or to "recover" to such a degree that it is no longer flowable under the high pressure which is used in the cure of the blanket. Preferably we incorporate a heat curing type of resin in the cushioning layer, and we also coat the blanket side of the synthetic linear polymeric textile with a rubber compound containing a heat curing resin. We do not impose the maximum pressure on the blanket until the heat curing resin has been so far advanced that the cushioning substance will not flow through the interstices of the weave. We prefer the use of a heat-curing resin because it increases the adhesion of the elastic cushioning layer to the synthetic linear polymer fabric and also because the resin sets up so quickly that the time of low pressure dwell is made short. Rubber technologists will recognize that several other substances are known which may be used to increase the specific adhesion of a rubber compound to a synthetic linear polymer, and such adhesion promoters can be used. However, the heat curing resins perform two functions and are preferred for that reason.

Alternatively, we may omit the resin and conduct the cure of the elastic cushioning compound and the blanket in two steps. The first step is conducted by heating the blanket while applying such a low pressure that the rubber compound will not flow through the interstices of the weave. When the rubber compound is cured or recovered to the correct degree, we apply the maximum pressure and finish the cure as the second step. The specific adhesion of the elastic cushioning layer to the synthetic linear polymer is not so high as when heat curing resins are used, but it is adequate for most purposes.

Textile print blankets perform two functions. Their surface layer carries away surplus color, but the blanket also acts as a power transmission belt. It drives the washer and frequently a considerable portion of the auxiliary apparatus in a printing range. It is to be understood that the body construction of our print blankets forms no part of our present invention and that body constructions may vary greatly, depending upon the power transmission requirements of the printing range. The example of the construction of the body sandwich which follows is one that has been found satisfactory for a wide range of requirements on printing machinery. It is set forth merely for the purpose of making the disclosure complete and is not to be considered as limiting the scope of the invention beyond that defined in the appended claims.

Rubber compounds used in the following examples make a tough, solvent resistant cushioning layer which has excellent adhesion to the body and to the working face. Interply cements produce a strong adherent bond. Rubber technologists will, however, recognize that the formulae are illustrative and that a large number of rubbery compounds of alternative formulae and compounded with different techniques can be used with equivalent results. Additionally, the technologists will recognize that rubber may be cured throughout a very wide temperature range depending upon its specific formulation. Although we prefer to cure the blanket at 315 to 325° F. and at pressures of about 500 lbs. per square inch, since we have found that blankets cured under these conditions are strong, long lived and resistant to the relatively high heats of the textile drying cans, it is well within the skill of the rubber technologist to formulate rubber compositions which cure at other temperatures and at other pressures and will give satisfactory service. Polyvinyl chloride and vinylidene chloride copolymers are not yet available as suitable fabrics. Tests with monofilaments (which are available) show that they reach the "sticking point" and scorch at such low temperatures that their use on a number of blanket dryers would not appear to be desirable or perhaps practical. If the blanket is not called upon to meet the exacting conditions found in a high speed textile printing range, as in silk screen printing, for instance, it does not have to be built to pass over blanket drying cans at high speed. Lower temperature curing rubber compounds would then permit the satisfactory use of a polymer at the working surface (polyvinylidene-vinyl chloride for example) which might become sticky or be damaged by the heats necessary to run a textile printing range at high speed.

A very large variety of fabric constructions, counts, yarns, and fabric thicknesses have been tested. Napped and unnapped, filament and staple fabrics have been tried. For the purposes of this invention there is no significant difference in weave and not much difference, except in the speed of drying, between filament and staple yarns. Filament yarns are preferred. Twill, taffeta and plain weaves all expel color satisfactorily. There is a limit in fabric thickness. If the original thickness of the fabric is less than .005 inch, there is not enough storage capacity in the working surface to hold the color without flushing unless the engravings are made much shallower than is customary. In general, it may be remarked that weaves having a count of less than that equivalent to 30 x 30 in a 210/2 filament nylon will be so open that the specific absorptivity per square inch of the blanket will be reduced below that which appears to be required.

There is a distinct limitation upon the thickness which is necessary in the elastic cushioning layer, which with the surface fabric ply forms the working layer of the blanket and which allows movement of the individual filaments making up the textile yarns. If the rubber in this layer is less than .005 inch in thickness, it is insufficiently thick to absorb the stresses in the printing operation. A blanket with a thinner cushioning layer will not have either the cleaning properties or the life which is necessary for a commercially successful product.

It should be obvious that it is the possession of definite physical properties, and that it is not the chemical nature of the filaments of the yarns, which gives operativeness of this invention. For example, the condensation reaction product of hexamethylene diamine and adipic acid is chemically distinct from polymeric acrylonitrile and that, in turn, is chemically distinct from the condensation product of a polycarboxylic acid and ethylene or other glycols, yet such chemical substances are operative. Many more synthetic resins which are known would likewise be operative if they were available as yarns or textiles.

It is essential that the fabric forming the working layer be insoluble in the medium in which the color is suspended. By far the greater proportion of the colors used in textile printing are suspended in water, and also most of the washing operations conducted on the blanket use water as the wash liquid alone. Therefore, in considering insolubility, commercially satisfactory results will be produced if the surface of the blanket is insoluble in water. A minor proportion of textile printing makes use of solvent solutions of a curing type resin emulsified in water. It is advantageous to produce blankets which are resistant to the solvents which are used in the process, as well as to water. The examples given in the specification utilize materials which are resistant to such solvents, but it is to be understood that this is an added advantage and that blankets satisfactory for the bulk needs of the industry may be made from materials which are resistant to water alone. For example, because of water susceptibility cellulose ester or regenerated cellulose yarns are not operative, but if the fiber forming the working surface is so resistant to water that it may be classed as hydrophobic, and if it otherwise possesses the physical characteristics which have been enumerated above, it is apparently suitable as a color carrying working surface of our textile print blanket.

Details of several versions of our improved textile print blanket and of a typical textile printing range equipped for using such a blanket may be seen by reference to the attached drawings.

Figure 1 is a conventionalized cross section of the blanket,

Figure 2 is a conventionalized cross section of the working layers of the blanket described in Example III,

Figure 3 is a conventionalized cross section of the variation of the blanket described in Examples VI and VII,

Figure 4 is a much enlarged top view of the blanket shown in Figure 3.

Figure 5 is an enlarged sectional detail of the working layer of the same blanket taken along the line 5—5 of Figure 4, and

Figure 6 is a diagrammatic elevation of a textile range showing the printing station, the washing apparatus, and the blanket drying cans.

A fragmentary, conventionalized cross section of the blanket is shown in Figure 1. This section is typical of cylindrical, heat resistant filament yarns such as nylon. The exposed fabric working surface is generally indicated at **11**. The exposed individual yarns are shown at **12**. A minor amount of rubber **14** penetrates the lowermost portion of the fiber bundle only. The cushioning and bonding layer of rubber is shown at **13**. The bonding ply of sail cloth (Example I), the use of which is optional, is shown at **10**. The blanket body is indicated generally at B.

For clarity in presentation, variant constructions are generally described in the following section. All specific examples appear at the end of the specification.

We have discovered that a valuable variant construction of our blanket may be made if the textile fabric which is chosen for the surface ply is composed of filaments which have a so-called "dog bone" cross section. A dog bone filament often results when the filament is spun from a solvent solution. If the volume of the filament shrinks as the solvent dries, and after the surface of the filament has become fixed, a cross section of the filament which results may be described as a modified figure 8 or a dog bone. The fibers of filament polyacrylonitrile may be taken as typical. If a square woven dog bone filament fabric is made the surface ply of the blanket and if the working face of the blanket during its cure is pressed against a polished platen or a chrome or a stainless steel sheet, it is found that the bundle of dog bone filaments making up the yarn has rearranged itself during the vulcanizing process with the result that the yarns assume a lens shaped cross section and the filaments, rather than having a more or less random arrangement in the yarn, line themselves up—at least on the outer surface of the yarn—as shingles on a roof. This is illustrated in Figure 2, a greatly enlarged, conventionalized cross section, drawn however from a macrophotograph. The warp yarn **15** is shown in transverse cross section. The filling yarn **16** is shown in longitudinal cross section. Dashes **17** in the cross section **15** indicate the generally parallel alignment of the filaments of the yarn after the cure has been completed. The elastic cushioning layer is shown at **18**. When such a blanket is removed from the vulcanizing press, it is found that the surface is essentially flat, smooth and has in large measure lost the crossed thread characteristic of a normal square woven textile. Instead, it appears as if a very fine sateen or even a continuous sheet forms the blanket surface. Nevertheless, the individual filaments are not fused together and are not compacted into a solid mass. The yarns retain their interfilamentary capillary capacity. Such a surface is capable of absorbing and carrying away a large quantity of color. It also will clean itself thoroughly by the same process of flooding with water and squeezing between squeeze rolls which has been described. Since the blanket is practically smooth, it is particularly useful for silks and other fine, thin fabrics which may be printed without showing any moire effect or the shadowing-through of any portion of the textile weave of the blanket.

We have found that we may increase the abrasion resistance of the surface of the blanket by buttressing each yarn at the exposed working surface with a small intrusion of rubber. To accomplish this, we close the press at, say 500 lbs./sq. in. after a preheat period of sufficient length to bring the rubber through its maximum slump and up on its recovery curve but, the pressure is applied while the rubber is, nevertheless, still sufficiently plastic to be driven through the interstices of the fabric at the elevated pressure. If the pressure is applied at the correct point on the recovery curve, we have found that the rubber will not flow to encase the yarns, but will stop wherever it comes into contact with the hot, polished plate. Wherever the yarns come in contact with the polished plate, they remain exposed and rubber-free. The result of this process is shown in Figures 3, 4 and 5. In Figure 3, the intrusions of rubber which rise to the working surface are indicated at **19—19**. The yarns are indicated at **21—21**. The elastic cushioning layer is shown at **22**. A top view, drawn from a macrophotograph, is shown in Figure 4. The white areas **21—21** show the exposed color receptive yarns. The black areas **19—19** show the rubber intrusions. An enlarged detail, conventionalized from a macrophotograph, shows the section on the line **5—5** of Figure 4. The yarns **21** (dog bone polyacrylonitrile) show the typical lens-shape configuration which they assume after curing the blanket under the heat and pressure.

In this way, a polyacrylonitrile yarn, which has the advantage possessed by dog bone filament yarns of forming a dead smooth surface when press cured, can be incorporated into a blanket which has an abrasion resistance quite comparable with that of a nylon working surface. The rubber columns resist the wear. There is a reduction in color carrying capacity, but the blanket is nonetheless wholly adequate for many printing conditions.

Another method of preventing the elastic cushioning and bonding layer from penetrating the working face of the blanket is to coat the working face of the synthetic linear polymeric textile with a blocking solution of such high viscosity that it coats but does not strike through to the opposite side of the fabric. When the blocking coat is applied, the low pressure pre-cure step may be considerably shortened and sometimes may be omitted entirely, since the blocking coat on the working face prevents any penetration of the elastic cushioning rubber into the working surface of the blanket. The blocking coat is a water soluble, film forming substance such as polyvinyl alcohol, or a 10% solution of hydroxyethel cellulose. Other film formers may be used provided that they are water soluble or water dispersible after the blanket has been cured and do not become brittle or crack or melt at the curing pressure and the curing heat. The blocking coating is removed by putting the blanket on a printing range and then running the range without color for a short time. During this time, the blanket washer will remove the blocking coating completely from the surface of the blanket and so leave the working surface of the synthetic linear polymeric textile exposed and available as pick-up and storage areas for textile printing colors.

When organic coloring substances such as pigment emulsion colors are run on the blankets, the emulsion breaks and the sticky resin solution is deposited on the fibers. The sticky film does not wash off the surface of the blanket easily, and it is not expelled effectively from the capillaries in the yarn. We have discovered that even resin emulsion colors may be run and that the blanket will clean itself properly as it passes through the squeeze rolls of the washer if a film forming detergent is first squeezed into the working surface of the blanket and then is dried to leave a film on the fibers before they come in contact with the emulsion color.

Figure 6 is a diagrammatic representation of the method and means we use to clean the blanket when pigment emulsion colors are being run. The blanket **23** loops around the bed roll **24**. The goods **25** run over the blanket **23** and beneath the color rolls **26—26**. The outrunning flight of the blanket which now is smeared with color loops around the washer roll **27**. Rotary brushes **28—28** drenched with water from the spray pipes **29—29** brush the working surface of the blanket. The blanket is squeezed between washer roll **27** and squeeze roll **31** and then is flooded with a detergent solution fed to the surface of the blanket through the drip pipe **32**, which is supplied from the stock tank **33**. The blanket is again squeezed between washer roll **27** and squeeze roll **34**, then passes over the drying cans **35—35** and returns to the printing station. Sometimes roll **34** can be omitted, and the detergent solution then is run onto the blanket just ahead of rolls **27** and **31**. The thin film of detergent which is left on the yarns after squeezing dries as the blanket passes over the drying cans. If the film is properly applied, color will be squeezed out of the yarns as the blanket passes through the bite between the rolls **27** and **31**. Satisfactory detergents are soap (1% sodium oleate in water), pine oil emulsion, several proprietary soap-detergent builder combinations, a proprietary pine oil substitute known as Terposol, and bentonite-sodium pyrophosphate suspensions.

In using emulsion colors, the important precaution is to take care that the hydrophilic detergent substance coats the individual fibers before any of the varnish-like resin deposit comes in contact with the surface of the blanket. If this precaution is taken, the emulsion colors may be cleaned from the blanket in a highly satisfactory manner.

Throughout the following examples two rubbers are used which are preferred because of their high resistance to ordinary rubber solvents. As we have explained, a solvent resistant textile print blanket is desirable, but is not necessary. When solvent resistance is not required, a large number of rubbery copolymers may be used in place of the neoprene rubber and butadiene acrylonitrile rubber which we prefer. These other polymers meet the mechanical requirements of a textile print blanket satisfactorily.

EXAMPLE OF BODY SANDWICH CONSTRUCTION

A typical body sandwich consists of a bottom or cylinder ply of fine cotton sailcloth, such as one with a 66 x 58 count and several plies of a fine cotton duck such as #12. The cylinder ply is coated on one side and the other plies on both sides with an interply cement based upon neoprene latex to a dry thickness of from 0.0005 to 0.001 inch. The interply cement is a typical curable latex cement chosen because of a reasonably high dry surface tack and a good solvent resistance. The water is removed from the coatings of interply cement and the duck inner plies are assembled on the sailcloth cylinder ply.

The various surface layers of our invention are assembled on a body sandwich of this nature and the entire assembly is cured under heat and pressure to form a unitary textile print blanket structure. Since such a body sandwich is common to all of the following examples, further details of its construction are not given as the description proceeds.

Example I

A plain weave nylon fabric of 63.5 x 45 count woven from 210/2 filament nylon in both warp and fill, weighing 7.03 oz. per square yard, and 0.0165 inch thick is scoured and heat set at 300° to 350° F. One surface of this fabric is coated with coating compound A:

FORMULA FOR COATING COMPOUND A

	Parts by weight
Phenol-formaldehyde resin (Durez resin 12687)	9
Ethyl alcohol	12
Phenol-formaldehyde resin is dissolved in the ethyl alcohol, and the solution is mixed with—	
Rubber cement #1*	200

*Formula for rubber cement #1:

Butadiene-acrylonitrile rubber (Perbunan #35)	295
Zinc oxide	15
Anti-oxidant	6
Sulphur	6
Cumarone-indene resin	60
Channel Black	146
Paraffin wax	9
Stearic acid	3
Accelerator (Santocure)	37
Propylene dichloride	2500

(The various dry ingredients are mixed together in an internal mixer to form a homogeneous compounded rubber batch, which is then dissolved in the propylene dichloride.)

Sufficient passes are given to deposit 0.43 lb. of dried material on each square yard of the fabric and the solvent is removed from the coating.

A bonding ply of fine cotton sailcloth of 66 x 58 count is coated with coating compound B:

FORMULA FOR COATING COMPOUND B

	Parts by weight
Phenol-formaldehyde resin (Durez resin 12687)	6.4
Ethyl alcohol	20.
Phenol-formaldehyde resin is dissolved in the ethyl alcohol, and the solution is mixed with—	
Rubber cement #1 (see formula above)	354.

Sufficient passes are given to deposit 0.75 lb. of dry ingredients on each square yard of the fabric and the solvent is removed from the coating.

The back surface of the sailcloth is coated with an interply cement based on neoprene latex to give a dry coating of about 0.0005 inch in thickness. The bonding ply is optional and may be omitted. An example of blanket construction omitting the bonding ply is given in Example IV.

The bonding ply indicated at **10** in Figure 1 is assembled on the outermost duck ply of the body sandwich B with its side which has been coated with the interply cement next to the body sandwich. The nylon surface ply **11** is then assembled on the bonding ply with its coated surface next to the bonding ply. The individual plies of the print blanket structure are spliced to form an endless belt. The thick coating of bonding ply **10** and the surface ply **11**, respectively, located between the plies in the assembled blanket structure forms the elastic cushioning layer **13** in the finished blanket. The assembled blanket structure is then passed stepwise under a large belting press under the following conditions:

1. The body of the platens is heated to 315° to 325° F.
2. The press is closed upon the blanket at low pressure, preferably below 100 lbs. per square inch.
3. Two minutes after the press has been closed at low pressure, the pressure is raised to 500 lbs. per square inch.
4. The dwell of the blanket at 315° to 325° F. and 500 lbs. per square inch pressure is continued for eight minutes.

Preferably, the entering margins of the platens are water cooled to produce a low temperature zone at the platen margins. This precaution avoids "step marks" in the blanket surface if care is taken to place that portion of the blanket which lay in the cooled zone in such a position that its cure will be completed in the next step.

Example II

One side of the surface ply fabric of Example I is coated with the following coating compound: Rubber cement #1 (for formula, see Example I).

Sufficient passes are given to deposit 0.5 lb. of dry solids on each square yard.

A bonding ply of fine cotton sailcloth of 66 x 58 count is coated on one side with rubber cement #1 to deposit 0.75 lb. of dry ingredients on each square yard.

The opposite surface is coated with a neoprene interply cement.

The neoprene coated side of the bonding ply is laid on the blanket body. The coated side of the surface ply fabric is laid on the bonding ply. The ends are spliced and the blanket is taken to the belting press.

The platens of the press are heated to 315° to 325° F. and the press is closed on the blanket at a pressure of 50 lbs. sq./in. or less.

After the lapse of six minutes, the pressure is raised to 500 lbs. sq./in. The blanket is press cured at this pressure for four minutes. The blanket proceeds stepwise through the press until the entire loop has been cured.

Example III

One face of the synthetic textile surface ply is coated with the following solution:

	Parts by weight
Polyvinyl alcohol (Evanol 72–51 high viscosity)	10
Water	90

The viscosity of this solution is such that it does not strike through to the opposite side of the fabric. It coats the yarns adjacent the outside surface and seals the interstices between the textile threads. The opposite face of the surface ply is then coated with rubber cement #1.

Sufficient passes are given to deposit 0.5 lb. of dry solids on each square yard.

A bonding ply of fine cotton sailcloth of 66 x 58 count is coated on one side with rubber cement #1 to deposit 0.75 lb. of dry ingredients on each square yard.

The opposite surface of the bonding ply is coated with a neoprene interply cement. The assembly follows Example II. The blanket is cured at 315° to 325° F. at a pressure of 500 lbs./sq. in. The pressure is applied immediately since the polyvinyl alcohol prevents the penetration of the rubber into the working face of the blanket.

Example IV

The surface ply is a polyacrylonitrile fabric having a count of 68 x 46, a warp of 200/2 and fill of 200/1 denier, weighing 5.25 oz. per square yard, and having a thickness of 0.015 inch. The yarns are made from 1.5 denier polyacrylonitrile (Orlon) filaments, 80 filaments making up a 200 denier yarn. This fabric is coated on one side with the following solution:

	Parts by weight
Butadiene-acrylonitrile latex (Hycar OR 25)	15
Compatible phenol-formaldehyde resin (Durez 14885 EM)	10
Hexamethylene tetramine	0.8
Water to give a yield of 0.1 lb. of dry solids per square yard of textile. When the above coating is dried, the coated surface is given a coating weighing from 0.3 to 0.4 lb. per square yard (dry weight basis) of latex coating composition #1	43

FORMULA FOR LATEX COATING COMPOSITION #1

	Parts by weight
Neoprene latex (#571)	415.
Wetting agent (Emulphor ON)	2.1
Sodium silicate	3.3
Ball mill batch*	112.
Methylcellulose	8.3
Anti-foam agent	0.1
Water	777.

* The composition of the ball mill batch is as follows:

	Parts by weight
Zinc oxide	90
Antioxidant (Agerite powder)	36
Retarder (Altax)	18
Calcium carbonate	90
Iron oxide, pigment grade, for color to aid in inspection only	4.5
Dispersing agent (Daxad 11)	4.5
Bentonite	2.5
Water	195.5

The dried coated fabric is built up on the body sandwich, the blanket plies are spliced, and the curing step proceeds as in Example I.

The so-called bonding ply of fine sailcloth which was used in Example I is not an essential part of the assembly. Its use is optional. When, however, the bonding ply with its coatings is not used, the outer surface of the top ply of the body duck is given an extra heavy coating of a cement compatible with the coating on the surface ply to yield approximately ½ lb. of solids per each square yard of the duck. In this example, for instance, the top surface of the outer duck ply of the body sandwich is coated with latex coating composition #1.

Example V

The same polyacrylonitrile fabric, as employed in Example IV, is coated on one side with the following compound:

	Parts by weight
Solvent neoprene curing compound *	100
Iron catalyst (6% in heavy oil)	1
Methylene bis (p-phenylene isocyanate) in orthodichlorobenzene (50% solids)	24

Sufficient compound is applied so that the dried coating weighs 0.1 lb. per square yard of fabric.

*Formula for solvent neoprene curing compound:

	Parts by weight
Neoprene rubber (Type 6N M–1)	100
Clay	100
Dibutyl sebacate	20
Zinc oxide	5
Magnesium oxide	4
Sodium acetate	1.5

These ingredients are milled to form a solid rubber composition, and this composition is dissolved in:

Toluene	225
Naphtha	75

The dried coating is overcoated with 0.5 lb. (dry weight basis) per square yard of fabric of latex coating composition #1, the formula for which is given in Example IV.

A fine sailcloth of 66 x 58 count is coated with latex coating composition #1 to yield approximately 0.4 lb. of dry solids per square yard. The opposite surface is coated with a neoprene interply cement. The assembly and cure of the blanket now follow Example I.

In press curing polyacrylonitrile fabrics it is recommended that a sheet of polished chrome or stainless steel be laid on the fabric. Dog bone yarns such as these rearrange themselves during cure. An extremely smooth, heated, metallic surface in contact with the yarns produces a very smooth working surface on the blanket.

Example VI

A plain fabric of 36 x 32 count with 200/3 polyacrylonitrile yarns in both warp and filling weighing 5.80 oz. per square yard and 0.0145 inch in thickness is coated and assembled into a blanket sandwich, according to Example V. A polished stainless sheet is laid on top of the polyacrylonitrile fabric. The press platens are heated to 315°–325° F., and the press is closed on the sandwich at about 50 lbs. per square inch. One to one and a quarter minutes thereafter the pressure is raised to 500 lbs. per square inch. The blanket is held at this pressure and temperature for 8½ to 9 minutes. The rubber cushioning and bonding compound is driven through the interstices of the fabric, but since the low pressure heating period is sufficient to stiffen the compound considerably, the rubber does not flow to encase the yarn but stops when it reaches the polished sheet. Each yarn where it was in contact with the polished sheet is exposed and rubber free. The blanket which results is shown in Figures 3, 4 and 5.

A blanket having characteristics similar to those of Example VI may also be made by the following procedure:

Example VII

The square weave polyacrylonitrile fabric used in Example VI is coated on one side with 0.5 lb. per square yard (dry basis) of coating compound A. A bonding ply of fine sailcloth is coated on one side with 0.75 lb. per square yard (dry basis) of coating compound B. The composition of each of these compounds is given in Example I. The other side of the bonding ply is coated in the usual manner with neoprene latex interply cement, the coatings are dried, and the blanket sandwich is assembled as given above. The assembled blanket sandwich is then cured according to the procedure given in Example VI.

Example VIII

A 32 x 30 count, 210/4 yarn in warp and filling, plain weave fabric of yarns spun from Du Pont Fiber V (said to be the polyester produced by the reaction of terephthalic acid and ethylene glycol) is coated with coating compound A to deposit 0.5 lb. of dried material on each square yard of fabric. This coated material is then treated according to Example I.

These blankets have given long, satisfactory service in full scale tests under factory conditions. The adaptability of these blankets has proved to be so commercially universal that one mill has decided to abandon the use of backgrays altogether and substitute these new blankets on all its printing ranges.

We claim:

1. A press cured textile print wash blanket comprising a flexible, compressible, laminated backing, and a working textile layer made of yarns formed from elastic cold-drawn fibers of a synthetic, linear, crystalline high polymer which is essentially insoluble in and impermeable to textile printing colors and water, said textile layer being spaced from the backing and adhesively united thereto by a substantial separate and distinct elastically distortable cushioning bonding layer of not less than .005" in thickness, which separate layer is insoluble in and impermeable to water and textile printing colors, the fiber surfaces at the working face of the blanket of the textile layer being exposed and available as pick-up and storage areas for textile printing colors.

2. A blanket according to claim 1, wherein the yarns of the textile layer in the working face of the blanket are only partially permeated by the material of the bonding cushion layer and are available as pick-up and storage areas for textile printing colors.

3. A blanket according to claim 1, wherein bundles of fibers comprising the yarn at the surface of the textile layer are only partially permeated by the material of the bonding cushion layer at the undersurface of the working layer and said partial permeation maintaining a random transverse orientation of the fibers in the permeated portion of the yarn, the remaining filaments of the yarn being transversely aligned in a generally parallel relationship, and the fiber surfaces at the working face of the textile layer being exposed and available as pick-up and storage areas for textile printing colors.

4. A textile print wash blanket according to claim 1 wherein the working textile layer is formed from fibers of nylon.

5. A textile print wash blanket according to claim 3 wherein the working textile layer is formed from fibers of an acrylonitrile polymer.

6. A textile print wash blanket comprising a flexible, compressible, laminated backing and a color absorbent textile layer, formed of yarns, united thereto, said blanket having a substantially plane working face comprising exposed areas of rubber and exposed textile-color absorbent areas of fibers from said textile layer, the fibers being elastic and being formed from a synthetic, linear, crystalline high polymer which is essentially insoluble in and impermeable to textile printing colors and water, said textile layer being adhesively united to the backing by an elastically distortable bedding and adhesive layer of rubber of not less than .005" thickness which is insoluble in and impermeable to textile printing colors and water, the adhesive layer only partially permeating the bundle of fibers comprising the yarn at the surface of the textile layer adjacent the backing but extending through the interstices of the textile to the opposite face to form said exposed areas of rubber thereon, the fiber surfaces at the working face of the textile layer being exposed and together with the unpermeated portions of the yarn being available as pick-up and storage areas for textile printing colors, the color absorbent areas and the rubber areas being uniformly distributed throughout the working face and each absorbent area being surrounded by rubber.

7. A textile print wash blanket according to claim 6 wherein the exposed color absorbent areas are composed of fibers of an acrylonitrile polymer.

8. The method of making a press cured textile print wash blanket comprising adhesively uniting to one surface of a flexible, compressible, laminated backing, by means of a heat curing adhesive layer, a working textile layer formed from yarns spun from elastic cold-drawn fibers of a synthetic, linear, crystalline high polymer, said uniting adhesive being insoluble in and impermeable to water and textile printing colors, limiting the flow of the heat curing adhesive layer while compressing and heating the backing, the adhesive layer and the working textile layer in a heated press to cause the adhesive layer to permeate only a minor cross section of the yarn adjacent the backing, the adhesive layer only partially permeating the yarns of the textile layer at the surface thereof adjacent the backing layer, and continuing the heat and pressure until a unitary heat and pressure cured blanket results, said adhesive layer having a thickness not less than .005".

9. The method of making a press cured textile print wash blanket comprising adhesively uniting to one surface of a flexible, compressible, laminated backing, by means of a heat curing adhesive layer, a working textile layer formed from elastic cold-drawn fibers of a synthetic, linear, crystalline high polymer, said fibers being essentially insoluble in and impermeable to textile printing colors and water, said uniting adhesive being insoluble in and impermeable to water and textile print colors, compressing the backing and the working layer together at a pressure insufficient to cause the adhesive to penetrate through the textile layer and below 100 pounds per square inch, maintaining the low uniting pressure and stiffening the adhesive by heating the blanket for a time sufficient to cause the adhesive to become resistant to flow under the intended curing pressure, then raising the pressure to the order of 500 pounds per square inch and completing the cure of the blanket by heat while maintaining said higher pressure on the blanket, said adhesive layer having a thickness not less than .005".

10. The method of making a press cured textile print wash blanket which comprises coating a textile formed from cold-drawn fibers of a synthetic, linear, crystalline high polymer, said fibers being essentially insoluble in and impermeable to textile colors and water, with a water solution of a water dispersible, film forming substance to coat the fibers of the textile adjacent one face and to block the interstices of said textile, drying the coating, applying a heat curing elastically distortable adhesive layer to the opposite face of said textile, laying the adhesive coated face of the textile on an uncured textile print blanket body, compressing the body and the textile layers together and curing the adhesive under heat and pressure in the presence of the applied blocking coating to permit the adhesive only partially to penetrate the textile layer at the side thereof adjacent the backing layer, then removing the blocking coating by washing the blanket to leave the fiber surfaces at and adjacent the working face of the textile layer exposed and available as pick-up and storage areas for textile printing colors, said adhesive layer having a thickness not less than .005".

References Cited in the file of this patent

UNITED STATES PATENTS

189,868	McBurney	Apr. 24, 1877
846,040	Mascord	Mar. 5, 1907
959,178	Streat	May 24, 1910
2,080,133	Jenkins	May 11, 1937
2,111,933	King	Mar. 22, 1938
2,175,051	Bromley	Oct. 3, 1939
2,202,020	Neiley	May 28, 1940
2,222,143	Farnworth et al.	Nov. 19, 1940
2,264,224	Swan	Nov. 25, 1941
2,269,125	Quenelle et al.	Jan. 6, 1942
2,410,415	Jones	Nov. 5, 1946
2,486,805	Seymour et al.	Nov. 1, 1949
2,625,499	Nebesar	Jan. 13, 1953