Oct. 7, 1941. W. J. SPARKS ET AL 2,258,268

PRESSURE ROLL FROM COPOLYMER

Filed April 13, 1939 2 Sheets-Sheet 1

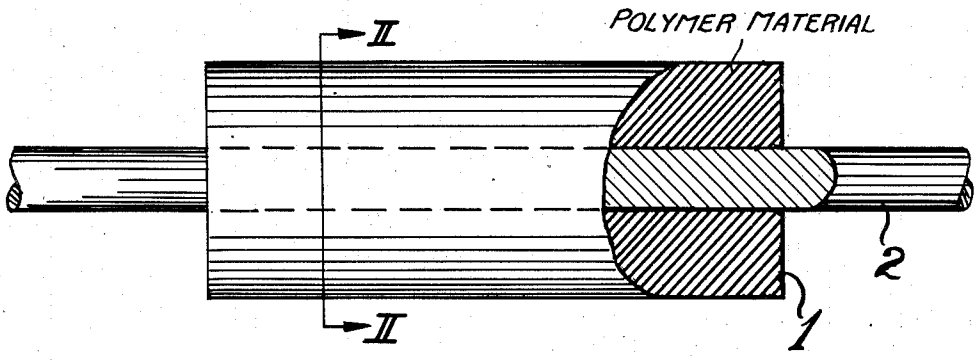


FIG.-1

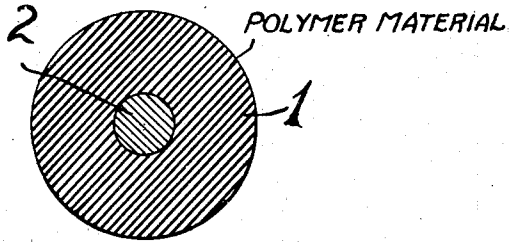


FIG.-2

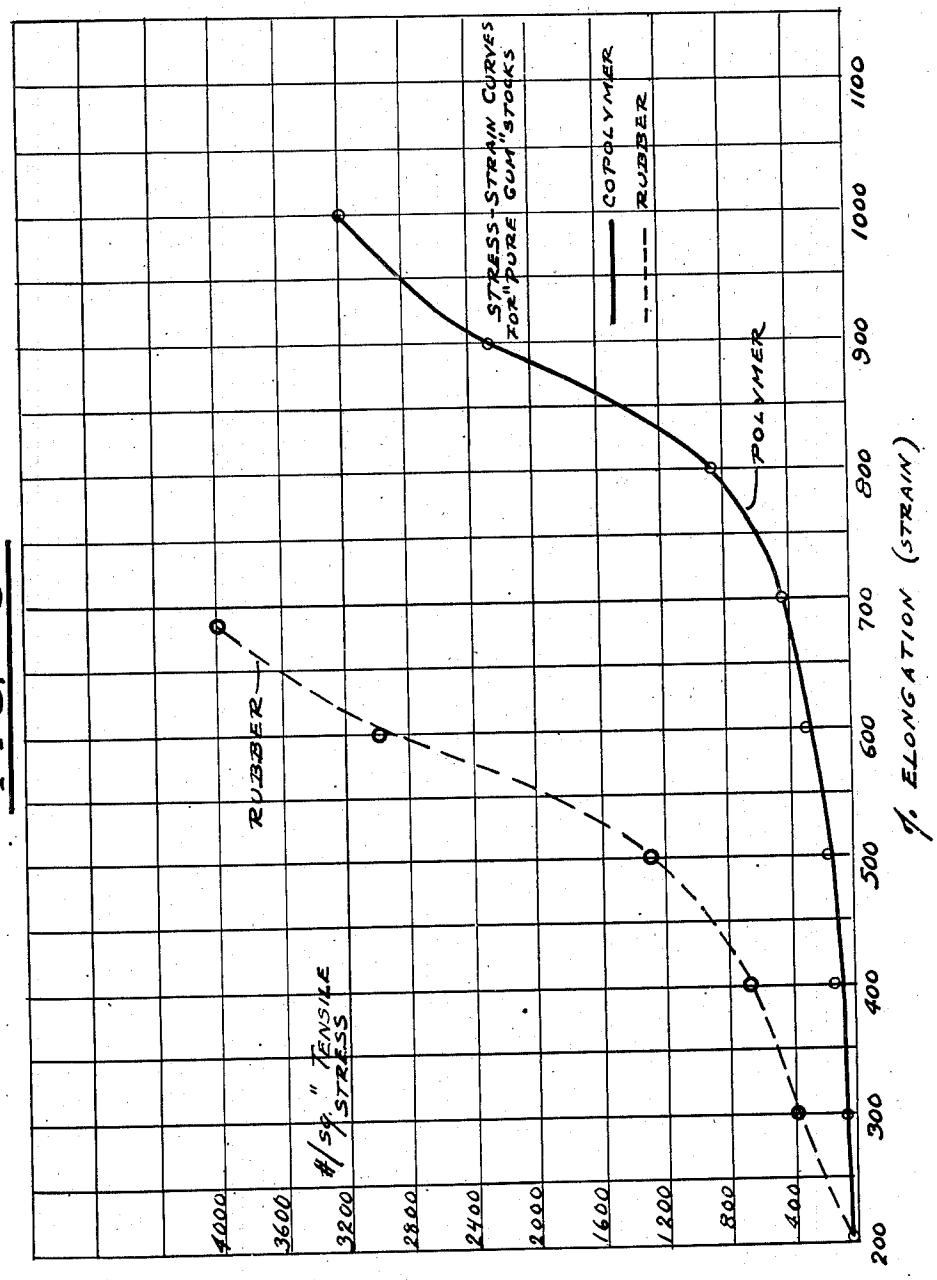
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FIG. 3



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PRESSURE ROLL FROM COPOLYMER

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9 Claims. (Cl. 68—277)

This invention relates to squeeze rolls, and particularly to a new and useful form of squeeze rolls having new, useful and unexpected characteristics, and produced from a new material.

Wringer rolls and squeeze rolls of various type have customarily been produced from rubber, but for many purposes they have been either unsatisfactory or useless, because of the fact that if they were set sufficiently close together to give the desired pressure on thin layers of material, excess pressure was applied to thicker areas, and if they were set far enough apart to produce the desired pressure upon average thickness of material, thin portions received little or no squeezing. Such rollers do not give uniform extraction of liquid from fabric, but leave portions of the fabric with much more contained fluid than other portions. Furthermore, rubber rolls are not adequately resistant to oils, or to oxidation, especially at the boiling point of water either from atmospheric oxygen or from oxidizing reagents such as chlorine-containing laundry materials and bleaches, or to chlorine-containing dyestuffs. Also rubber rolls are useless for squeezing or drying fabrics washed in solvent, and for fabrics being treated with oily materials, or for oily fabrics. Furthermore, rubber rolls have a relatively very short life and for these various reasons are commercially unsatisfactory, and commercially useless for large scale liquid treating operations of fabric, to the extent that centrifugal extractors have substantially completely replaced wringer rolls in laundries, dye works and other large scale fabric processing plants.

The present invention provides a wringer roll construction in which a new material having new and unexpected characteristics is used for a new type of wringer rolls in which a relatively light and uniform pressure is applied to material of varying thickness. This material is a new polymer produced by the interpolymerization of isoolefins and diolefins such as isobutylene and butadiene and it has the new, unusual and unexpected characteristic of showing a large elastic displacement with a relatively small change in stress.

The new polymer when made into rolls applies a uniform pressure to fabric being squeezed therebetween, with little regard to differences in thickness of the material being squeezed. Furthermore, the polymer material is highly resistant to bleaching agents, chlorine-containing agents and oxidizing agents, and it gives a uniform pressure upon the entire body of fabric, thereby permitting the use of such rollers in dye vats, to increase the speed of penetration of dye solutions into the fabric, while maintaining a uniform penetration, and uniform amount of dyestuff or other treating material in the fabric. Furthermore, the rolls are useful with bleaching solutions, and the rapid removal and replacement of bleaching solution attainable by rolls passing the fabric from the bleach bath back into the bleach bath produces a highly advantageous speeding up of the bleaching operation, and a valuable increase in the uniformity of the bleaching action throughout the fabric.

Furthermore, the rolls are useful for the impregnation of fabric with various oils and varnishes, either dissolved in solvent, or emulsified in water.

Thus an object of the invention is to squeeze materials of widely varying thicknesses and apply a nearly equal squeezing pressure to wide ranges of thickness simultaneously. Other objects and structural details of the invention will be apparent when read in connection with the accompanying drawings wherein

Fig. 1 is a side view partly in section of rolls according to the invention;

Fig. 2 is a sectional view of the same rolls along the lines II—II; and

Fig. 3 is a stress displacement curve showing the characteristics of the polymer material.

In the course of the operation of cracking petroleum products to increase the yield of gasoline, a substantial quantity of gaseous by-product results which contains considerable proportions of isobutylene and butadiene. It has been found that this material when mixed in the proportion of approximately 70–90 parts of isobutylene and 30–10 parts of butadiene can be polymerized at temperatures ranging from —50° C. to —150° C. by the use of aluminum chloride dissolved in ethyl chloride, to produce a solid polymer of very high molecular weight material which is plastic and elastic.

This material is nearly chemically saturated, but it can be compounded with sulfur to the extent of approximately 5 parts per 100 of polymer material to saturate it completely, chemically, and to increase the elasticity and to develop an elastic limit. The resulting sulfurized polymer material has a very high tensile strength, in the neighborhood of 3,000 pounds per square inch. In addition, the material is strongly resistant to oxidation, to acid, to alkali, and to most of the common solvents except the light hydrocarbons and chlorinated hydrocarbons. In addition, the

material is "soft" as distinguished from rubber which is merely elastic. This difference is clearly shown in Fig. 3. It will be observed that the displacement of rubber is much less for a given stress or pressure than is the case with the polymer material. That is, when rubber is stretched or compressed, it "gives" by an elastic flow, but the pressure required per unit of elongation or plastic flow is relatively great, whereas the present polymer material, at low stress values such as 400 pounds per square inch, will stretch four to five times as much as rubber, and at high stress values such as 3200 pounds per square inch the elongation is nearly double that of rubber.

Referring to the figures, wringer rolls may be prepared by moulding the polymer material 1 in a mould of the desired cylindrical form with an axle 2 at the center of the rolls as indicated in Figs. 1 and 2.

For this purpose the polymer prepared as above described may be compounded with sulfur fillers and sulfurization aids according to the following formula:

	Parts
20% butadiene, 80% isobutylene polymer	100
Whiting	15
Zinc oxide	5
Stearic acid	5
Sulfur	5
Sulfurizing catalyst	0.5 to 4

This formula contains as its major constituents the polymer material, to which is added a pigment filler which may be carbon black or may be zinc oxide or may be clay or may be any one of a wide range of inert fillers. In addition, approximately 5 parts per 100 of polymer are provided of sulfur for the above-mentioned sulfurization reaction, and sulfurization aids in the form of Monex (tetra methyl thiuram monosulfide), Tuads (tetra methyl thiuram disulfide) and butyl zimate (zinc salt of dibutyl dithio carbamate) and the like are likewise provided. In addition, small quantities of stearic acid may be added if desired since the stearic acid aids the sulfurization reaction. A sufficient quantity of the material may then be introduced into a suitable mould around a suitable axle, and the material may be heated to a temperature of approximately 260° F. (about 125° C.) for a period of time ranging from one quarter to four hours to complete the sulfurization reaction.

Alternatively and for some purposes, the sulfur may be omitted, and a cure obtained merely by heating the material with a suitable amount of pigment fillers and a small proportion of a sulfurizing catalyst such as Tuads (tetra methyl thiuram disulfide) which is found to give a satisfactory cure without the presence of any additional free sulfur.

Upon the completion of the sulfurization, the rolls may be mounted in an appropriate frame with pressure applying and adjusting means and driving means. The rolls are desirably put under pressure in the absence of materials therebetween, in order to apply the desired pressure upon the thinnest material. As indicated in the figures, especially Fig. 3, the rolls will give with a very little increase in pressure when materials of considerably greater thickness are introduced, and they will even give sufficiently to pass hard objects such as buttons without imposing undue pressure thereon, and at the same time a different portion of the roller pair between which there may be only a relatively thin portion of material will still apply to the thin portion only very slightly less pressure than is applied to the thick portion.

Wringer rolls so constructed are particularly advantageous for the various processing involved in bleaching and dyeing fabric "in the piece" in view of the high resistance of the rolls to dye chemicals and bleaching agents generally, and the absence of corrodible metal which harms the dye bath. Furthermore, wringers so constructed are much simpler, more convenient and less expensive than a centrifugal hydro extractor of comparable capacity; they operate at much lower speeds and with lower power requirements, and in addition avoid the use of the metallic basket of the usual extractor.

Furthermore, the rolls are conveniently usable in the presence of many of the oils as shown by the following table:

Solvent	Increase in weight	
	Copolymer material	Rubber
	Percent	*Percent*
Almond oil	None	74
Cottonseed oil	15	41

By the device of the invention there is thus produced a wringer roll construction which is adapted to apply nearly the same amount of pressure simultaneously along the contact line of the rolls to widely varying thicknesses of material; a thing which has previously been impossible of attainment.

The above-described embodiment utilizes a polymer material produced from mixed isobutylene and butadiene. Similar polymers which can be sulfurized and cured in the same way can be produced from other analogous mixtures. For instance, isobutylene in the proportion of 95 to 99 parts together with isoprene in the proportion of 5 parts to 1 part may be polymerized together by the same catalyst and the same procedure to produce a polymer material which is substantially identical in physical characteristics with the above-described polymer produced from isobutylene and butadiene. Likewise an analogous polymer may be made from a mixture of 95 parts to 99.5 parts of isobutylene with 5 parts to 0.5 part of cyclo-pentadiene by the same polymerization process and catalyst. Similarly, an interpolymer is readily produced from isobutylene which, also is substantially identical chemically with the polymer obtained from isobutylene and butadiene. (The latter polymer is, of course, chemically distinguishable by analysis for chlorine from the other polymers.) Similarly, the iso-olefin best described as methyl ethyl ethylene may be polymerized with butadiene in mixtures ranging between those for isobutylene-butadiene and those for isobutylene-isoprene. Similarly, the methyl ethyl ethylene may be polymerized with isoprene and chloroprene to produce similar polymer which likewise may be compounded with sulfur and cured to produce similar cured polymer rolled materials.

While there are above described but a limited number of embodiments of the device of the invention, it is possible to produce still other embodiments without departing from the inventive concepts herein disclosed and it is therefore desired that only such limitations be imposed on the appended claims as are stated therein or required by the prior art.

The invention claimed is:

1. A squeeze roll having the characteristics of being solid, plastic and elastic formed from a sulfurized polymeric material including isobutylene and butadiene produced from a mixture of 70 to 90 parts of isobutylene with 30 to 10 parts of butadiene, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of aluminum chloride dissolved in ethyl chloride.

2. A squeeze roll having the characteristics of being solid, plastic and elastic formed from a sulfurized polymeric material including isobutylene and butadiene produced from a mixture of 70 to 90 parts of isobutylene with 30 to 10 parts of butadiene, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of aluminum chloride dissolved in ethyl chloride, compounded with sulfur and inert filler materials.

3. A squeeze roll having the characteristics of being solid, plastic and elastic formed from a sulfurized polymeric material including isobutylene and butadiene produced from a mixture of 70 to 90 parts of isobutylene with 30 to 10 parts of butadiene, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of aluminum chloride dissolved in ethyl chloride, compounded with sulfur, inert filler materials and sulfur reaction aids.

4. A squeeze roll having the characteristics of being solid, plastic and elastic formed from a sulfurized polymeric material including isobutylene and butadiene produced from a mixture of 70 to 90 parts of isobutylene with 30 to 10 parts of butadiene, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of aluminum chloride dissolved in ethyl chloride, compounded with sulfur, inert fillers, sulfur reaction aids and stearic acid.

5. A squeeze roll device having the characteristics of being solid, plastic and elastic formed from a sulfurized polymeric material comprising an interpolymerized mixed polymer of an isoolefin and a diolefin produced from a mixture of 70 to 99.5 parts of the isoolefin with 30 to 0.5 part of the diolefin, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of dissolved aluminum chloride.

6. A squeeze roll device having the characteristics of being solid, plastic and elastic formed from a polymeric material comprising an interpolymerized mixed polymer of an isoolefin and a diolefin produced from a mixture of 70 to 99.5 parts of the isoolefin with 30 to 0.5 part of the diolefin, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of dissolved aluminum chloride, the said interpolymer being compounded with sulfur and cured by the application thereto of heat and pressure.

7. A squeeze roll device having the characteristics of being solid, plastic and elastic formed from a polymeric material comprising an interpolymerized mixed polymer of an isoolefin and a diolefin produced from a mixture of 70 to 99.5 parts of the isoolefin with 30 to 0.5 part of the diolefin, respectively, polymerized at temperatures between —50 and —150° C. by the application to the mixture of dissolved aluminum chloride, the said interpolymer being compounded with sulfur and cured by the application thereto of heat and pressure at a temperature ranging from 120° C. to 170° C. for a time ranging from one-quarter hour to four hours.

8. A squeeze roll having the characteristics of solidity, plasticity and elasticity formed from a sulfurized polymeric material including isobutylene and isoprene obtained from a mixture of isobutylene in the proportion of 95 to 99 parts with isoprene in the proportion of 5 parts to 1 part, respectively polymerized at temperatures between —50 and —150° C. by the application of dissolved aluminum chloride.

9. A squeeze roll having the characteristics of solidity, plasticity and elasticity formed from a sulfurized polymeric material including isobutylene and cyclo-pentadiene produced from a mixture of 95 parts to 99.5 parts of isobutylene with 5 parts to 0.5 part of cyclo-pentadiene polymerized at temperatures between —50 and —150° C. by the application of dissolved aluminum chloride.

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