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MANUFACTURE OF RUBBER GLOVES

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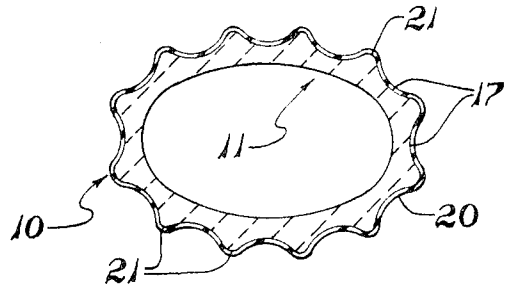


FIG. 2

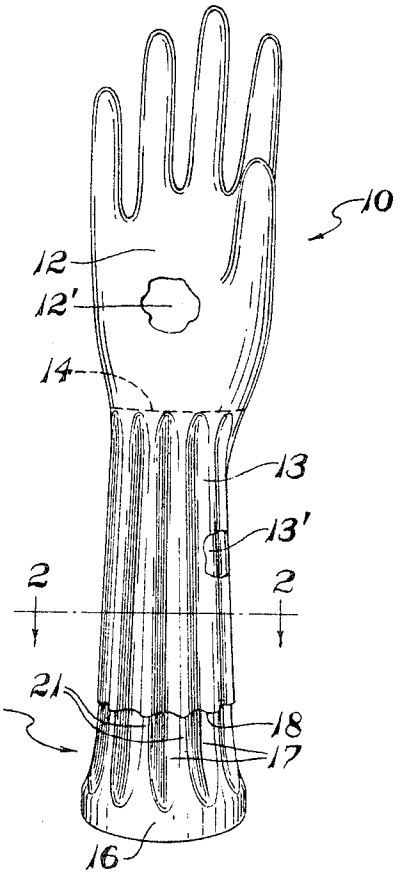


FIG. 1

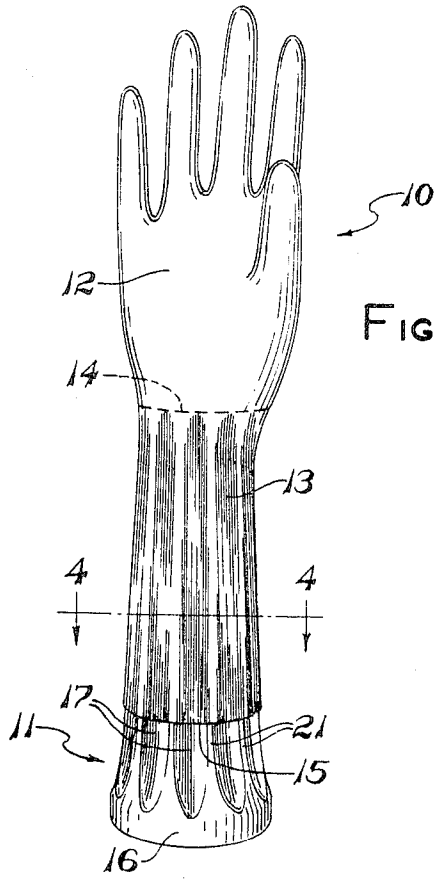


FIG. 3

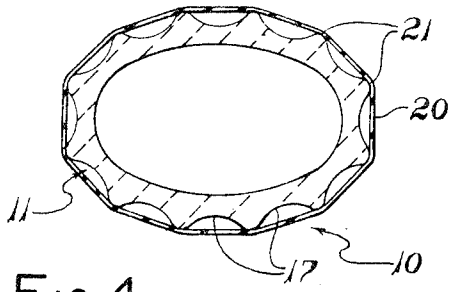


FIG. 4

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MANUFACTURE OF RUBBER GLOVES

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7 Claims. (Cl. 264—303)

This application is a division of copending application Serial No. 250,879, filed January 11, 1963.

This invention relates to a dipping form for manufacturing rubber gloves and more particularly pertains to a dipping form for manufacturing rubber surgical gloves that have strengthened cuff portions and to a method for making said gloves.

When surgical gloves are donned by a doctor or nurse, the usual technique for pulling on the glove involves having another hold the glove open while the doctor or nurse thrusts the hand into the glove. This technique understandably exerts a considerable strain on the wrist portion of the glove at those areas being grasped by the assistant. Even if one attempts to put on a surgical glove without assistance by grasping the wrist portion of the glove with one hand and pulling the glove onto the hand, considerable force is applied to the wrist portion in tugging at the glove. The strain exerted on the cuff portion of the glove in pulling the glove on or in removing the glove is sufficient that frequently the glove will be torn in the cuff portion in the attempt to pull the glove on or off unless the cuff portion of the glove is objectionably thick.

For many years surgical gloves have been made by a process which involved dipping a smooth-surfaced porcelain or aluminum glove form finger-first into a solution of latex coagulant (usually a solution of calcium nitrate in alcohol) and gently heating the form after its withdrawal from the coagulant bath to evaporate the alcohol from the solution of coagulant remaining on the glove form after its removal from the coagulant bath and thereby form a thin deposit of coagulant on the surface of the glove form. The glove form then is dipped finger first into a compounded latex and held in the latex composition until the desired thickness of rubber is deposited on the glove form after which the glove form is withdrawn from the latex. The rubber deposit then is leached with water to remove water soluble materials from the deposit, dried, and vulcanized, and after trimming and rolling the edge is stripped from the glove form as a finished glove. This process inherently resulted in a glove having a hand and finger portion that had a greater wall thickness than the cuff portion of the glove. For example, when a glove made in this manner has a wall thickness in the hand and finger portion of between about 0.006 to 0.007 inch thick, the cuff portion of the glove has a wall thickness of only between about 0.005 to 0.006 inch. While the wall thickness of the hand and finger portion of such a glove would be satisfactory, the wall thickness of the cuff portion is so thin that it does not have sufficient strength to satisfactorily withstand the stresses of repeatedly donning and doffing the glove.

Merely increasing the wall thickness of the cuff portion of the glove by depositing a thicker layer of coagulant on the glove form and increasing the time the form is immersed in the latex compound is not a satisfactory solution to the difficulty, since although the wall thickness of the cuff portion of the glove would be thickened as a result so also would be the wall thickness of the hand and finger portion. Doctors and nurses using surgical gloves normally require a very high degree of tactile sensitivity in the finger portions of the glove in order to perform the many sensitive and delicate movements and manipulations necessary during a surgical operation. The thicker the

wall of the finger portions of a surgical glove, the less tactile sensitivity the doctor or nurse wearing the glove possesses. Therefore, when the wall thickness of the cuff portion of the glove is increased it is done so at the expense of the tactile sensitivity available to the doctor or nurse. When making surgical gloves by the process described above, a compromise obviously was necessary. Consequently, such gloves have been produced with a cuff portion having a wall thickness somewhat thinner than that felt desirable and a hand and finger portion having a wall thickness somewhat thicker than is felt desirable.

Various suggestions have been made for providing a more satisfactory glove. One such suggestion involves dipping the glove form fingers first into the latex compound, immersing the entire form in the latex, reversing the form without removing it from the latex and partially withdrawing the form fingers first from the latex until the hand and finger forming portion of the glove form is withdrawn from the latex leaving the cuff forming portion of the glove form in the latex. In this manner, the cuff forming portion of the glove form remains in the latex for a longer period of time than the hand and finger forming portion of the glove form. After the desired extra thickness in the cuff portion has been deposited the form is removed from the latex and the glove is finished in the same way as previously discussed.

A variation of the process described in the next preceding paragraph involves dipping the glove form into th latex compound in such a way that the cuff forming portion of the glove form enters the latex compound first, i.e. the form is lowered into the latex compound fingers up. The lowering of the glove form into the latex continues until the finger forming portions of the glove form are completely beneath the surface of the latex compound. After a desired thickness of rubber is deposited on the glove form, the process is reversed and the form is withdrawn fingers up from the latex compound. In following this procedure it will be noticed that the cuff forming portion of the glove mold enters the latex compound first and leaves it last. This longer period of dwell time of the cuff forming portion of the glove form in the latex compound, as compared to the hand and finger forming portions of the glove mold results in a glove having a cuff portion with greater wall thickness than the wall thickness of the hand and finger portions.

The present invention involves a process quite different from those heretofore employed. In accordance with this invention, a glove form having a series of generally parallel flutes extending longitudinally from the wrist area toward the base of the glove form is used, the flutes extending to beyond the dip line of the form. It has been found that when using a glove form having the fluted or grooved construction in the cuff forming portion of the form, a glove having both the desired thin wall in the finger portions necessary for tactile sensitivity and the thicker wall in the cuff portion necessary for pulling the glove on and off without ripping the glove results. Since the glove preferably is made by the conventional latex dip technique heretofore employed for making surgical gloves, existing dipping apparatus can be used in practicing this invention.

The invention will be more fully understood by referring to the drawing in which:

FIG. 1 is a front elevation view of a glove form embodying this invention and having a deposit of undried rubber disposed thereon;

FIG. 2 is an enlarged view on the line 2—2 of FIG. 1;

FIG. 3 is a front elevation view of the glove form shown in FIG. 1 except showing the rubber deposit on the glove form after the deposit has been dried and vulcanized; and

FIG. 4 is an enlarged view on the line 4—4 of FIG. 3.

Referring to the drawings, the glove **10** deposited on glove form **11** for the purposes of discussion may be considered to consist of two main sections, namely, (1) the hand and finger portion of the glove (including the thumb compartment) identified by the numeral **12** and (2) the cuff portion of the glove identified by the numeral **13**. The hand and finger portion **12** of the glove covers the hand of the wearer and extends from the finger tips to the imaginary line **14** that corresponds to the wrist line of the wearer when the glove is worn. The cuff portion **13** of the glove extends from the aforesaid imaginary wrist line **14** to the open end of the glove at the cuff edge **15**.

The glove form **11** also for the purposes of discussion may be considered to consist of two sections which correspond essentially to those of the glove. Accordingly, the glove form **11** can be considered to comprise a hand and finger portion **12'** (which includes the element for forming the thumb of the glove) that extends from the finger elements of the mold to the imaginary wrist line of a glove formed on the glove form, and a cuff portion **13'** which extends from the imaginary wrist line to the base **16** of the form.

The hand and finger portions **12'** of the glove form **11** conforms in shape to the equivalent portion of a conventional smooth-surfaced glove form used for making dipped gloves from latex. The cuff portion **13'**, however, differs from conventional glove forms in that it has a series of generally parallel flutes or grooves **17, 17** which extend longitudinally from within the cuff forming portion of the form toward the base **16** of the glove form beyond the dip line **18**. (The dip line **18** is the line, either real or imaginary, on the form to which the glove form is dipped when it is immersed in the latex bath.) Preferably the flutes **17, 17** extend longitudinally commencing at about the wrist line toward the base **16** of the glove form beyond the dip line **18** (as shown in FIGS. 1 and 3) so that the entire cuff portion of the glove has a thickened wall, although in those situations where it is not essential or is not desired to increase the wall thickness of the entire cuff portion of the glove the flutes **17, 17** need extend longitudinally only from points within the cuff forming portion, i.e. from points between the wrist line and the dip line **18**, toward the base **16** of the glove form beyond the dip line **18**. In the latter case, only a zone of the cuff of the glove adjacent the glove edge **15** is thickened instead of the entire cuff. The flutes **17, 17** preferably extend around the entire periphery of the cuff portion of the glove form and adjacent flutes preferably are equally spaced from each other. It normally is desired to have a sufficient number of flutes of sufficient depth to increase the circumference of a transverse section of the cuff portion from 15 to 30 percent as compared to what the circumference of that section would be if no flutes were present.

The provision of flutes **17, 17** which extend from the wrist line to a point beyond the dip line **18** results in the formation of a glove that has a thicker wall in the cuff portion of the glove than is present in the hand and finger portion of the glove. As the glove form **11** is withdrawn from the latex compound, the deposit of rubber **20** adhering to the surface of the form **11** conforms in shape to the contour of the form **11** following the lands **21, 21** and depressions of the fluted cuff portion **13'**, as is shown in FIGS. 1 and 2. However, as the deposit of uniform thickness is dried and vulcanized, the rubber deposit **20** disposed in the flutes **17, 17** contracts and pulls out of flutes **17, 17** to become suspended between the lands **21, 21** of the fluted cuff portion **13'**, as shown in FIGS. 3 and 4. A thickening of the deposit accompanies the contraction so that as a consequence the wall thickness of cuff portion **13** of glove **10** increases as the rubber deposit **20** is dried. The reason for this thickening of the deposit in the region of contraction is not fully understood and probably is the combination of several factors. It has been observed, however, that this thickening does not occur when the rubber deposit **20** is confined in the valleys of the flutes and is prevented from contracting during the drying and vulcanizing operation. Thus, the desired result is not obtained when the flutes **17, 17** extend within the cuff forming portion of the form but terminate short of the dip line **18**, since the rubber deposit forms a seal with the form at the dip line **18** and prevents air from entering between the rubber deposit and the form at the flutes and equalize the pressure above and below the rubber deposit as it commences to contract. Without such equalization the rubber deposit is prevented from pulling out of the flutes and the desired thickening of this portion of the glove cannot occur.

The use of the fluted cuff portion in the glove form permits the economical manufacture of a surgical glove with a thin wall in the hand and finger portion to provide maximum tactile sensitivity and a thicker wall in the cuff portion to provide the strength needed in this portion of the glove to withstand the forces exerted on the glove cuff when pulling the glove on or when taking it off. For example, a glove made on the glove form shown in the drawings by first dipping the form in a 10 percent solution of one or more coagulants (such as a 10 percent aqueous solution of a 50–50 mixture of calcium and zinc nitrate), drying the coating of coagulant solution thus deposited on the glove form, dipping the coagulant coated glove form finger-first into a 30 percent total solids latex dipping composition for a dwell time of about 30 seconds followed by leaching the rubber deposit and drying and vulcanizing it on the glove form for 25 minutes at 120° C. resulted in a glove having a wall thickness in the hand and finger portion of about 0.007 inch and a wall thickness in the cuff portion of about 0.009 inch.

A rubber latex glove which has been formed by the above method does not have the identical appearance of a rubber latex glove formed on more conventional forms. Although the hand and finger portion does have the appearance of the conventional surgical glove, the cuff portion where the rubber deposit **20** upon contraction has pulled from flutes **17, 17** and became suspended between lands **21, 21** acquires "impressions" in the cuff wall corresponding in configuration to the flutes of the glove form except that they are less pronounced than would be the case if the rubber deposit had not contracted but had conformed to the fluted surface of the form.

We claim:

1. A dipping form for manufacturing rubber latex gloves that have a thicker wall adjacent the cuff edge than the wall thickness of the hand and finger portion of the glove which dipping form comprises a hand and finger forming portion and a cuff forming portion, said cuff forming portion having a series of generally parallel longitudinally disposed flutes which flutes begin within said cuff forming portion of the dipping form and extend away from the hand and finger forming portion and toward the base of the dipping form to beyond the zone of the dipping form to which a rubber deposit is applied when said dipping form is dipped fingers first into a rubber latex when utilizing the dipping form.

2. The dipping form of claim **1** wherein said series of flutes extend around the entire circumference of the cuff forming portion of the dipping form.

3. The dipping form of claim **2** wherein said series of flutes extend from about the division between the cuff forming portion of the dipping form and the hand and finger forming portion of the dipping form away from the hand and finger forming portion and toward the base of the dipping form to beyond the zone of the dipping form to which a rubber deposit is applied when said dipping form is dipped fingers first into a rubber latex when utilizing the dipping form and wherein the circumference of the cuff forming portion measured around a transverse section through the fluted part thereof is from 15 to 30 percent greater than would be the circumference of said section if the said flutes were not present.

4. A method for making a rubber glove from latex which comprises depositing a layer of latex coagulant onto the surface of a glove form having a hand and finger forming portion and a cuff forming portion and having a series of generally parallel longitudinally disposed flutes which begin within said cuff forming portion of the glove form and extend away from the hand and finger forming portion toward the base of the glove form to beyond the zone of the glove form to which a rubber deposit is to be applied when said glove form is dipped fingers first into a latex composition in making a rubber glove, said layer of latex coagulant extending over the entire surface of the glove form to which a rubber deposit is to be applied, applying a deposit of rubber of uniform thickness onto the surface of the hand and finger forming portion of the glove form and onto the surface of the cuff forming portion of the glove form by immersing the coagulant-coated glove form fingers first into a latex composition only to said zone of the glove form to which the deposit of rubber is to be applied and retaining said glove form so immersed in said latex composition for a time sufficient to deposit a layer of rubber of the desired uniform thickness on said glove form, withdrawing said glove form from said latex composition, and heating the deposit of rubber on the glove form to dry and vulcanize the deposit which causes the portion of the rubber deposit disposed in the said flutes to contract and pull free of said flutes and become suspended on the lands separating said flutes which contraction causes a thickening of the wall of that portion of the rubber deposit disposed over the fluted zone of the glove form.

5. A method for making a rubber glove from latex which comprises depositing a layer of latex coagulant onto the surface of a glove form having a hand and finger forming portion and a cuff forming portion and having a series of generally parallel longitudinally disposed flutes extending around the entire circumference of the cuff forming portion which flutes begin within said cuff forming portion of the glove form and extend away from the hand and finger forming portion toward the base of the glove form to beyond the zone of the glove form to which a rubber deposit is to be applied when said glove form is dipped fingers first into a latex composition in making a rubber glove, said layer of latex coagulant extending over the entire surface of the glove form to which a rubber deposit is to be applied, applying a deposit of rubber of uniform thickness onto the surface of the hand and finger forming portion of the glove form and onto the surface of the cuff forming portion of the glove form by immersing the coagulant-coated glove form fingers first into a latex composition only to said zone of the glove form to which the deposit of rubber is to be applied and retaining said glove form so immersed in said latex composition for a time sufficient to deposit a layer of rubber of the desired uniform thickness on said glove form, withdrawing said glove form from said latex composition, and heating the deposit of rubber on the glove form to dry and vulcanize the deposit which causes the portion of the rubber deposit disposed in the said flutes to contract and pull free of said flutes and become suspended on the lands separating said flutes which contraction causes a thickening of the wall of that portion of the rubber deposit disposed over the fluted zone of the glove form.

6. A method for making a rubber glove from latex which comprises depositing a layer of latex coagulant onto the surface of a glove form having a hand and finger forming portion and a cuff forming portion and having a series of generally parallel longitudinally disposed flutes which begin within said cuff forming portion and extend from about the division between the cuff forming portion of the glove form and the hand and finger forming portion of the glove form away from the hand and finger forming portion toward the base of the glove form to beyond the zone of the glove form to which a rubber deposit is to be applied when said glove form is dipped fingers first into a latex composition in making a rubber glove, said layer of latex coagulant extending over the entire surface of the glove form to which a rubber deposit is to be applied, applying a deposit of rubber of uniform thickness onto the surface of the hand and finger forming portion of the glove form and onto the surface of the cuff forming portion of the glove form by immersing the coagulant-coated glove form fingers first into a latex composition only to said zone of the glove form to which the deposit of rubber is to be applied and retaining said glove form so immersed in said latex composition for a time sufficient to deposit a layer of rubber of the desired uniform thickness on said glove form, withdrawing said glove form from said latex composition, and heating the deposit of rubber on the glove form to dry and vulcanize the deposit which causes the portion of the rubber deposit disposed in the said flutes to contract and pull free of said flutes and become suspended on the lands separating said flutes which contraction causes a thickening of the wall of that portion of the rubber deposit disposed over the fluted zone of the glove form.

7. A method for making a rubber glove from latex which comprises depositing a layer of latex coagulant onto the surface of a glove form having a hand and finger forming portion and a cuff forming portion and having a series of generally parallel longitudinally disposed flutes extending around the entire circumference of the cuff forming portion which flutes begin within said cuff forming portion and extend from about the division between the cuff forming portion of the glove form and the hand and finger forming portion of the glove form away from the hand and finger forming portion toward the base of the glove form to beyond the zone of the glove form to which a rubber deposit is to be applied when said glove form is dipped fingers first into a latex composition in making a rubber glove, said layer of latex coagulant extending over the entire surface of the glove form to which a rubber deposit is to be applied, applying a deposit of rubber of uniform thickness onto the surface of the hand and finger forming portion of the glove form and onto the surface of the cuff forming portion of the glove form by immersing the coagulant-coated glove form fingers first into a latex composition only to said zone of the glove form to which the deposit of rubber is to be applied and retaining said glove form so immersed in said latex composition for a time sufficient to deposit a layer of rubber of the desired uniform thickness on said glove form, withdrawing said glove form from said latex composition, and heating the deposit of rubber on the glove form to dry and vulcanize the deposit which causes the portion of the rubber deposit disposed in the said flutes to contract and pull free of said flutes and become suspended on the lands separating said flutes which contraction causes a thickening of the wall of that portion of the rubber deposit disposed over the fluted zone of the glove form.

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