July 13, 1954 G. B. LENHART 2,683,263

NONLAMINATED MONOSTRUCTURE RUBBER GLOVE

Filed Jan. 26, 1951 2 Sheets-Sheet 1

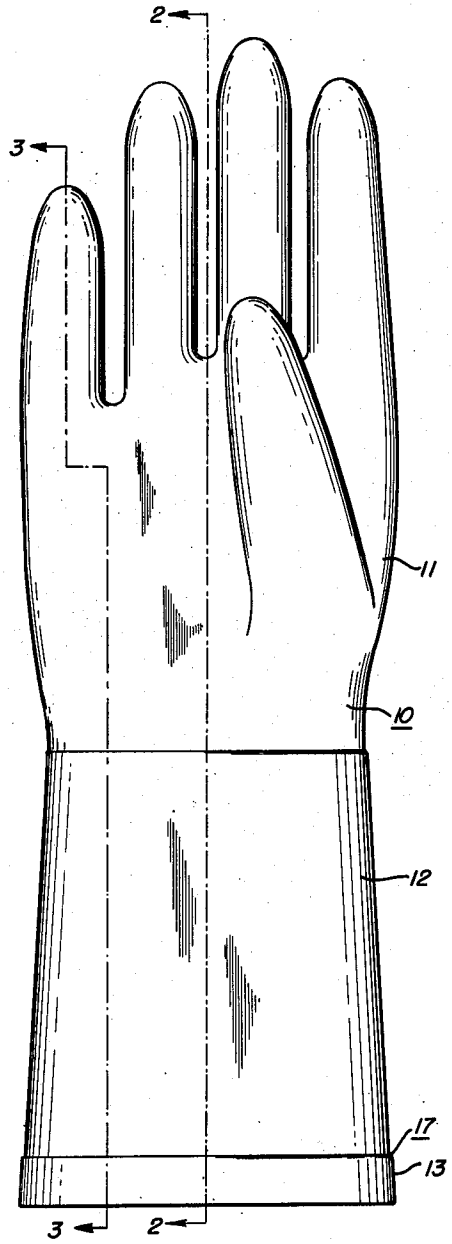

Fig. 1

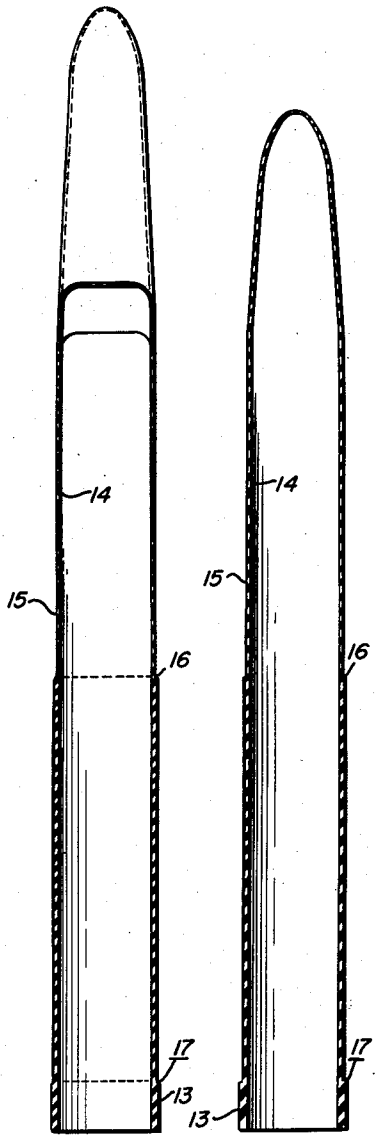

Fig. 2

Fig. 3

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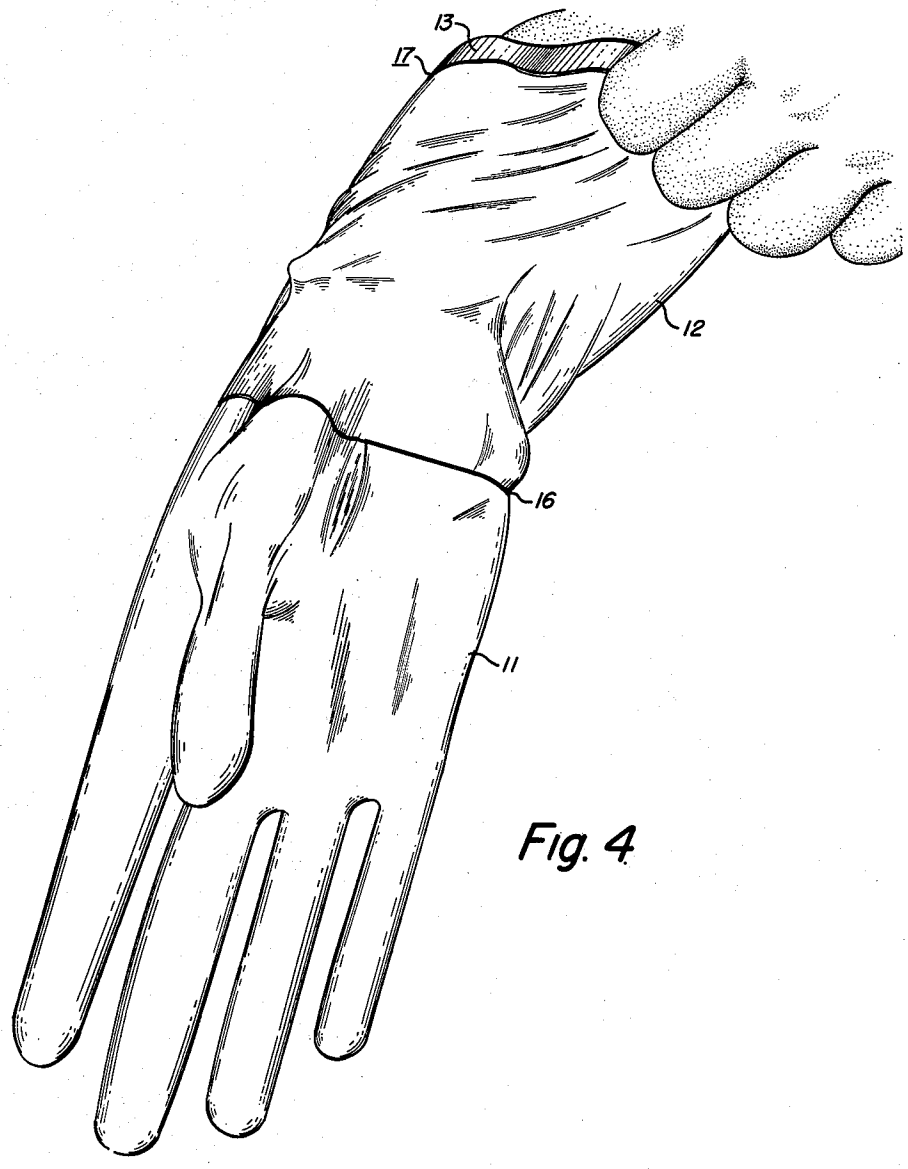

Fig. 4

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NONLAMINATED MONOSTRUCTURE RUBBER GLOVE

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3 Claims. (Cl. 2—168)

1

This invention relates to rubber glove structures and relates particularly to gloves for doctors and surgeons.

An object of this invention is to provide a rubber glove having a finger covering area of minimum thickness.

Another object of this invention is to provide a doctor's rubber glove having a finger covering area flimsily thin, but which is constructed to withstand hasty stretching in putting the glove on.

Still another object of this invention is to provide a rubber glove which will grip tightly on the wearer's wrist to hold the hand portion of the glove tight on the wearer's hand.

Yet another object of this invention is to provide a monostructure rubber glove to prevent disintegration of the glove.

And another object of this invention is to provide a monostructure rubber glove with a cuff band of roll resistant thickness.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 of the drawings is an elevational view of a glove embodying the principles of this invention, as viewed from the palm side of the glove;

Figure 2 is a sectional view taken along line 2—2 of Figure 1;

Figure 3 is a sectional view taken along line 3—3 of Figure 1; and

Figure 4 is an illustration of the glove of this invention being pulled onto the wearer's hand, and illustrating the extreme stresses placed upon the glove while the wearer's hand is being inserted into the glove.

Problems

Doctors and surgeons, as is well known, must wear rubber gloves when performing their duties, especially in the operating room. These surgeons must have a rubber glove with the fingers as thin as reasonably possible in order that they can feel through the gloves with reasonable accuracy for doing such fine jobs as tying very thin cord. For example, some doctors and surgeons employ number 60 thread for tying blood vessels and must be able to feel this cord and handle it with ease even with rubber gloves on their hands. It is even more true, of course, that the doctor or surgeon must be able to handle his equipment with ease and be able to feel through the glove as he performs his delicate task.

The doctor must get into his rubber gloves

2

without contaminating the outer surface of the gloves. These gloves are packaged by folding the gloves in a cloth strip with the cuff of the glove turned back. The gloves, packaged in the cloth strip, are sterilized in an autoclave under active live steam pressure at something in the neighborhood of 250 degrees Fahrenheit. Usually the gloves are powdered both inside and out. In some hospitals where student nurses are in training, a nurse will grasp the sides of the cuff on the glove and open the glove for the doctor to thrust his hand into the glove with ease. However, most hospitals, especially in the smaller communities, do not have extra nurse help in the operating room. Therefore, the nurses that are available have their specific duties in preparing instruments for the doctors and do not aid the doctors in placing their garments and gloves on. Therefore, after the doctor receives the folded cloth with the gloves therein, he is obliged to place them on his own hands. In Figure 4 of the drawings, the operation of placing the gloves on a surgeon's hand is illustrated for the condition where the surgeon places his own glove on his hand. Even though a doctor will wear rubber gloves before actually touching a patient in an operating room, that doctor goes through a strict cleansing operation which he terms "scrubbing." The hands are washed for a considerable length of time as far up as the elbow. Thus the surgeon's hands are as sterile as he possibly can make them. However, his hands are not absolutely sterile, whereas the rubber gloves are absolutely sterile when they come from the autoclave. Therefore, when the doctor places his gloves on his own hands he makes every effort to avoid touching his skin, even though has has thoroughly scrubbed, with the outer surface of the sterile gloves. In placing the gloves on his hands, the doctor thrusts the four fingers up under the turned cuff of the first glove, and usually places his thumb down inside the glove to help open the glove for insertion of his hand. The hand that holds the glove open is bare, and might touch the skin of the other hand, but no contamination will result from this accidental touching and therefore, it does not matter that the doctor has his thumb inside of the cuff where it might be contacted by the bare skin of the hand being inserted into the glove. The bare hand touching the outside of the glove touches only at the upper wrist hand band portion, away from the hand portion which must be kept sterile, and therefore, the contact of the bare hand at

the upper wrist has no contaminating effect on the entire glove.

After having installed one glove on one hand, the doctor must then use the rubber covered hand to help install the other glove on the bare hand. In this case the doctor cannot place his thumb inside of the glove to aid in opening the glove wide for the entry of his remaining bare hand, because his bare skin might accidently touch that sterile outer surface of the thumb on the gloved hand and contaminate the sterile surface. The doctor, therefore, places his four fingers under the cuff, substantially as illustrated in Figure 4, and pulls the glove open in that manner. Such opening with the fingers under the cuff only is even a greater strain than pull exerted upon the glove when the thumb may be inserted into the top of the glove. In spite of the fact that the gloves are well powdered, there is considerable friction between the powdered hand and the rubber glove, and accordingly, there is a great strain placed on the flimsy rubber glove in forcing the hand into place.

The sterilization, as previously stated, normally takes place in an autoclave at about 250 degrees Fahrenheit. This autoclaving is carried on for about fifteen minutes. Those acquainted with the rubber art will readily realize that such an extreme temperature has a highly deleterious effect upon thin rubber used for making surgeons' gloves, and very often the sterilization will be carried on until the rubber becomes rotten and the fingers may be pulled off as the surgeon's hand is forced into the glove, or the side of the wrist may split open as the surgeon attempts to pull the glove over his hand. Of course, the thinner the rubber, the more apt the sterilization process is to cause undue deterioration of the rubber and result in failure of the glove. Nevertheless, the surgeon needs a hand covering area as thin as can possibly be achieved.

Prior art

Doctors and surgeons have long used a type of glove having an overall general thickness which is a compromise between the desirable extremely thin finger covering, and the practical strength needed to resist the effect of the doctor's pull on the wrist area of the glove in placing the glove on his hand. Many gloves are still made today by a single dip of either latex or cement rubber with the cuff formed by rolling a portion of the wrist area of the glove upon itself before the glove is cured. This beaded type of cuff band is provided by trimming the material on the mold prior to curing the rubber, and then rolling the material down a short way. Some manufacturers of rubber gloves have attempted to improve upon the conventional glove by placing a flat band of rubber around the cuff edge of the glove rather than providing a rolled bead edge. A flat band at the cuff of the glove has been found to prevent undue tendency of the wrist portion of the glove to roll down upon the surgeon's wrist while he is working. In other words the cuff band, being a thick and narrow band, resists rolling upon itself, and therefore, resists the attempt of the glove to roll as the surgeon brushes against his coat and other objects during his work. It is, of course, obvious that the surgeon desires to have his gloves fully up upon the arms of his gown rather than rolling down about his wrist as he works. The cemented glove cuff has been found to be entirely satisfactory for preventing the glove from rolling, but the band very often fails and comes loose under the extreme autoclave sterilizing temperatures and the subsequent extreme stressing of the wrist area and cuff area of the glove by the surgeon when installing the gloves on his hands. Furthermore, the provision of a flat band to prevent undue tendency for the glove to roll does not in any manner overcome the need for a glove with extremely thin finger areas.

Attempts to make rubber gloves extremely thin in order that the surgeon may have the greatest ability to feel with his fingers, have resulted in failure and have been discarded, because the wrist area of the glove is then entirely too thin to withstand the extreme abuse to which the surgeon places the wrist area in installing the glove upon his hand.

There have been numerous attempts, both patented and unpatented, to provide a wrist area for a rubber glove which is thicker than the hand portion of the glove. These attempts have failed wholly in the field of rubber gloves for surgeons. As previously pointed out, a cuff band cemented to the wrist portion of the glove is unsatisfactory for the reason that the cemented surfaces tend to pull apart under the extreme stresses of use. Attempts along a similar line to provide a second layer on the wrist area of the glove, laminated to the original glove with rubber cement, have failed for the same reson. Electrician's gloves have been made with extremely heavy wrist portions by dipping and redipping until a sufficiently thick body has been built up. Attempts to produce such a structure with surgeon's gloves has been unsatisfactory because it has been found that even though the several dips take place prior to any vulcanization, nevertheless, the various dips tend to produce distinct laminated layers and after the glove has been sterilized in the autoclave up to the very limits of its usefulness, these laminated structures will show up and cause failure.

This invention

In this invention a rubber glove 10 is provided having a flat cuff band 13, a molded hand portion 11, and an intermediate wrist portion 12 extending between the cuff 13 and the hand portion 11. This glove 13 has a nonlaminated monostructure with a continuous stepless inner wall surface 14, but having a continuous stepped outer wall surface 15. It has been found that a glove as illustrated in the drawings may best be made by dipping in latex, although rubber cement, rubber dispersions, resins, and other similar materials may be used if desired. However, particularly for surgeon's gloves, latex is believed to be the better material. Latex of the common composition used for making rubber gloves is satisfactory for the purpose of making the gloves of this invention. This latex compound may contain the usual accelerators and vulcanizing materials, together with any coloring matter if so desired. Usually with surgeon's gloves no coloring matter is added. It has been found that the best method of making the surgeon's glove illustrated in the drawings is to expose the mold to the latex solution in three different continuous steps in order to provide a maximum period of immersion for the cuff portion 13, and the least period of immersion for the hand portion 11. It is believed preferable to dip the glove mold finger-first into the solution and immerse the mold completely under the surface of the solution, whereafter the mold is brought out of the solution finger-first up to the wrist portion of the mold. That is, the mold is brought through the surface of the

solution until the solution covers the mold just behind the thumb area of the mold. The mold is then allowed to remain in that position with the hand raised out of the solution and the wrist still remaining in the solution until a greater deposit of rubber is placed upon the wrist area of the mold. The mold may then be raised until only the cuff band area remains in the solution, whereupon the mold is again allowed to remain in the solution for an extended period of time to deposit a still thicker deposit of rubber for the purpose of making the heavy wrist band area 13. It is not essential that the steps given be followed in that manner, and other methods of dipping may be employed. For example, if desired, the mold may be moved very slowly rather than making a distinct stop. However, in order to enjoy the benefits of an extremely thin finger portion with a tough and stretch resistant wrist area for withstanding the extreme stresses placed upon the glove by the surgeon in installing the glove, it is essential that the dipping be carried out as one continuous process for depositing the extra rubber in the wrist area and in the cuff area and building the entire glove into one monostructure without any cementing or lamination, such for example as by redipping.

In the illustrated embodiment of the invention the wall of the glove is a solid and continuous monostructure in which the inside surface 14 is continuous and stepless, but the outside surface 15 is stepped. The outside surface 15 has a blended wrist step 16 and a blended cuff step 17. It may be noted from the sectional views 2 and 3 that there is no lamination of any kind in the construction of this improved glove, and that the area in the steps 16 and 17 are blends from one sectional thickness to the other. The blended areas will be considerably extended, or merged, if the slow removal method suggested above is employed.

It has been found by the construction herein illustrated and described that the hand portion may be made much thinner than ever before believed to be practical. The hand thickness, for example, has been found to be practical when made as thin as five to ten thousandths of an inch thick. This extreme thinness, for convenience of expression, has been termed "touch transparency."

The factor that makes the extremely thin hand portion practical is the discovery that by having a monostructure of hand and wrist portion, wherein the wrist portion is considerably thicker than the hand portion, the stresses placed upon the glove by the surgeon are all concentrated in the wrist area where the glove contour from the hand to wrist provides the smallest area of the glove. Therefore, the wrist area, being much stronger and tougher than even the conventional glove, having a wall thickness of substantially ten to twenty thousandths of an inch, will easily withstand the stresses placed thereon by the surgeon and the surgeon may easily force his hand through the reduced area at the base of the hand portion in the glove without placing any stress whatsoever on the hand portion. Therefore, the hand portion need not be as strong. There is no force or stress placed upon the hand portion because the wrist portion has taken up all of the stress. Once the surgeon's hand begins to pass into the hand portion a sliding friction takes place and overcomes the static friction which is evident as the installation of the glove upon the surgeon's

hand is commenced. It is well known that sliding friction is considerably less than static friction. However, it has also been found that the glove must be a monostructure in order that failure will not be brought about due to separation of laminations because of the intense sterilization in the autoclave.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A rubber glove having a hand portion of thin wall section to cling closely to the wearer's hand and transmit a maximum of touch sensitivity therethrough, a flat cuff band, and an intermediate wrist portion extending between said cuff band and said hand portion, said glove having a non-laminated monostructure made in a single continuous dip upon a form by withdrawing the form at a variable speed, from a dipping solution, said hand portion having a first thickness, said cuff portion having a second thickness greater than said hand portion first thickness, said second thickness providing roll resistance for said cuff band, and said wrist portion being tough and stretch resistant with a third thickness intermediate the thickness of said hand portion and cuff portion.

2. A molded glove having a hand portion and a wrist portion, said glove having a non-laminated monostructure with a continuous stepless inner wall surface, a continuous stepped outer wall surface, said hand portion having a first thickness, and said wrist portion being tough and stretch resistant with a second thickness greater than the thickness of said hand portion.

3. A molded glove made by a single continuous dip upon a form by withdrawing the form at a variable speed from a dipping solution, said glove having a flat cuff band, a molded hand portion, and an intermediate wrist portion extending between said cuff band and said hand portion, said glove having a non-laminated monostructure with a continuous stepless inner wall surface, a continuous stepped outer surface, said hand portion having a first thickness within a range of substantially five to ten thousandths of an inch, said cuff portion having a second thickness within a range of substantially twenty to twenty-six thousandths of an inch to provide roll resistance for said cuff portion, said wrist portion being tough and stretch resistant with a third thickness intermediate said hand portion and cuff portion thickness thereby having a range from substantially ten to twenty thousandths of an inch.

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