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APPARATUS AND PROCESS FOR MAKING LATEX SURGICAL GLOVES

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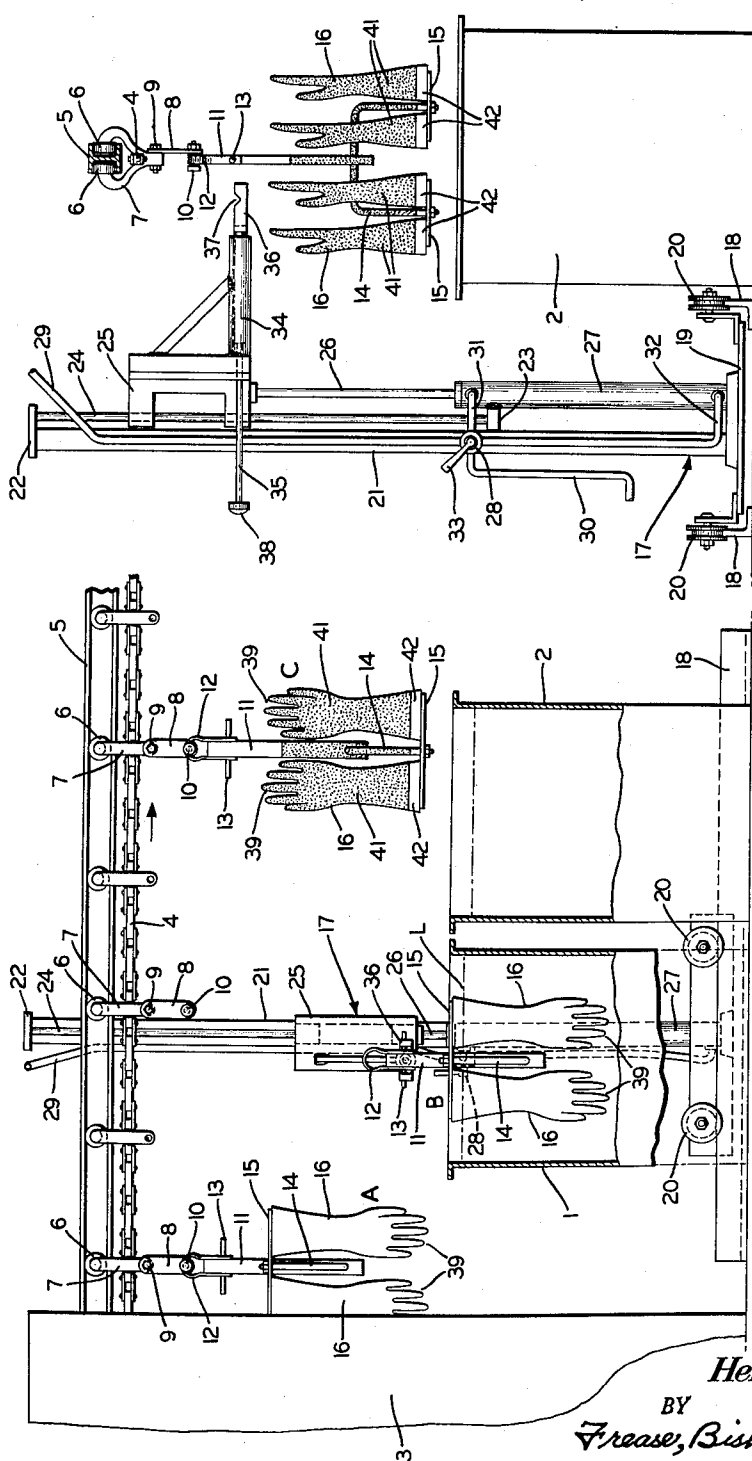
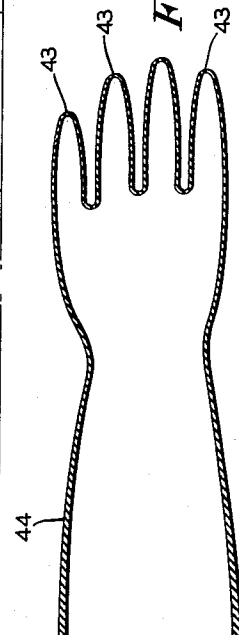


Fig. 2

Fig. 3



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APPARATUS AND PROCESS FOR MAKING
LATEX SURGICAL GLOVES

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6 Claims. (Cl. 18—24)

The invention relates to apparatus and process for mold-
ing latex rubber goods by dipping, and more particularly
to the production of surgical gloves having tapered wall
thickness.

In the making of latex gloves it is necessary that the
glove form be first dipped into a coagulant solution and
subsequently into liquid latex, so that the coagulant film
upon the form will pick up sufficient latex to form a glove.
If the form were dipped into latex, without being first
coated with a film of coagulant, the film of latex upon the
form would be so thin as to be useless, being a maximum
of only .001" to .002" thickness at its thickest portion at
the very bottom of the form.

Prior to my invention the general practice of making
dipped latex surgical gloves has been to dip a rack of
forms, finger-tips down, into a coagulant solution to a
specified depth, remove from the coagulant solution and
revolve the forms to help distribute the coagulating film
on the forms, then dip, finger-tips first, into liquid latex
and remove the forms finger-tips last after sufficient time
for the coagulant to pick up the required amount of latex
necessary for forming a glove of required thickness.

The finger-tips of the forms being thus immersed in the
latex for the longest time, picked up the greatest thickness
of latex film. In an attempt to work some of this surplus
deposit of latex at the finger-tips, down the wrist portions
of the gloves, the forms were again revolved.

As a consequence, the great majority of latex gloves
reach the market with about .010" thickness at the finger-
tips and .008" thickness at the wrist. This is not a satis-
factory surgical glove. It is necessary that surgeons have
rubber gloves with the fingers as thin as reasonably possi-
ble in order that they can accurately feel through the
gloves as they perform their delicate tasks.

It has been found that for best surgical procedure, a
glove should have a thickness of .006" to .007" at the
finger-tips. In order to withstand the extremely high
strains to which surgical gloves are subjected, by the man-
ner in which surgeons pull the gloves upon their hands,
the wrist portions of the gloves should have a thickness of
over .010". It was possible to produce gloves of such
varied thicknesses in the old style multiple dip gloves of
pure rubber, but latex gloves having these proportions
have never been placed upon the market prior to my in-
vention.

Although it is known that apparatus has been designed
for dipping latex gloves having relatively thin finger-tips
and relatively thick wrist portions, such apparatus has not
been commercially practical owing to the fact that in the
operation of dipping latex gloves, such apparatus pro-
duced such an excessive amount of scrap latex that the
cost of producing gloves thereon was prohibitive. It
is believed that this is the reason that latex gloves pro-
duced by such apparatus have never to my knowledge
been placed upon the market.

A primary object of the present invention is the pro-
vision of apparatus and process by which latex surgical
gloves, having relatively thin finger-tips and relatively
thick palm and wrist portions, may be economically pro-
duced with a minimum of latex scrap.

Another object of the invention is to provide an appa-
ratus and process for forming dipped latex surgical gloves,

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which overcomes the above-described difficulties and dis-
advantages of the prior art.

A further object of the invention is to provide appa-
ratus and process for dipping glove forms finger-tips first
into a coagulant solution and then dipping the forms
finger-tips up into liquid latex.

A still further object of the invention is to provide appa-
ratus comprising a horizontal conveyor moving at constant
speed, revolvable racks carrying glove forms, and a port-
able dipping machine for removing racks from the con-
veyor and dipping the forms tips first into a coagulant
solution and then tips up into liquid latex, and then re-
placing the racks upon the conveyor.

Another object of the invention is to provide apparatus
including a rack carrying a plurality of glove forms with
means for revolving the rack upon a horizontal axis so
that the forms may be dipped with the finger-tips down
into a coagulant solution and then with the finger-tips up
into liquid latex, the rack and its supporting frame being
so constructed that only a minimum portion thereof will
be immersed in the coagulant.

A further object of the invention is to provide appa-
ratus of the character referred to in which the speed of the
conveyor is so timed that the operator can go through the
cycle of removing a rack of forms from a trolley on the
conveyor, dip the forms, finger-tips down, into the co-
agulant, dwell, raise the forms out of the coagulant,
revolve the rack, dip the forms, finger-tips up, into the
latex, and replace the rack on the same trolley on the
conveyor when that trolley has traveled the distance be-
tween two form-carrying trolleys.

A still further object of the invention is to provide
such apparatus in which each form-carrying rack com-
prises a depending frame member having a loop or eye
at its upper end for detachably mounting upon a trolley
or stud bolt on the conveyor, and a U-shape member
pivotaly connected to the frame and carrying a plurality
of glove forms.

Another object of the invention is to provide apparatus
of this character including a portable dipping machine
movable to positions adjacent to the coagulant tank and
the latex tank, and having a vertical fluid-operated cylin-
der for vertically moving a piston rod, a horizontal arm
on the piston rod, and means on said horizontal arm for
removing a rack of forms from the conveyor, supporting
the rack of forms for dipping into the coagulant and
latex, and for then replacing the rack upon the conveyor.

The above and other objects, apparent from the draw-
ings and following description, may be attained, the above-
described difficulties overcome and the advantages and
results obtained, by the apparatus, construction, arrange-
ment and combinations, subcombinations and parts which
comprise the present invention, a preferred embodiment
of which, illustrative of the best mode in which applicant
has contemplated applying the principle, being set forth
in detail in the following description and illustrated in
the accompanying drawings.

In general terms, the invention may be briefly de-
scribed as comprising a coagulant solution tank and a
liquid latex tank, and a horizontal conveyor located above
the tanks, with means for moving the conveyor at a con-
stant speed.

Trolleys or stud bolts are located at uniformly spaced
points upon the conveyor and glove-form-carrying racks
are suspended therefrom. Each rack comprises a sup-
porting frame member suspended from one of the con-
veyor trolleys by a loop or eye at its upper end detach-
ably mounted upon the trolley.

A U-shaped member is pivotaly connected to the sup-
porting frame member and carries a plurality of glove
forms, whereby the forms may be suspended from the

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frame member with the finger-tips of the forms either up or down as desired. The rack and supporting frame are so constructed that only a minimum portion thereof will be submerged in either the coagulant or the latex when the forms are dipped.

A portable dipping machine is movable to positions adjacent to the coagulant tank and the latex tank as desired. The dipping machine includes a fluid-operated cylinder having a vertically movable piston rod upon which is mounted a horizontal tubular arm within which is slidably located a rod having a bifurcated, notched member on one end and an operating handle at its other end.

The supporting frame member for the form-carrying rack has a pin located transversely therethrough and extending beyond opposite sides thereof. To remove a rack from the conveyor, the cylinder is operated to raise the horizontal arm to the proper height, to engage the pin on the frame in the notches of the bifurcated member and lift the loop or eye off of the trolley and, by means of the handle, the slidable rod is pulled back to disengage the rack from the conveyor.

The cylinder is then operated by a four-way valve, to lower the piston rod at constant speed, lowering the rack of forms, with the finger-tips down, into the coagulant to a short distance from the wrist ends thereof, and the valve is then operated to raise the forms, at constant speed, out of the coagulant.

After the finger-tips of the forms are raised above the top of the coagulant tank, the operator revolves the rack around its pivot to position the forms with the finger-tips up, and the dipping machine is moved to position adjacent to the latex tank.

Then, after a proper drying interval of the coagulant film on the entire forms, except the small uncoated portions at the lower ends thereof, the valve is operated to lower the forms at constant speed, with the finger-tips up, into the liquid latex.

After a proper dwell to permit the coagulant film on the forms to pick up the desired thickness of latex deposit thereon, the valve is operated to raise the rack and forms at constant speed, out of the latex tank and to sufficient height to position the loop or eye of the rack frame in register with the same trolley or stud bolt on the conveyor.

The handle is operated to push the rod toward the conveyor so as to engage the loop with the trolley, and the arm of the dipping machine is lowered by the valve to disengage the notches of the bifurcated member from the pin on the rack frame, and the rack of latex-coated forms is carried by the conveyor through the usual washing, drying and curing operations, after which the gloves are stripped from the forms.

At this time, the very thin deposit of latex at the very bottoms of the forms and the rack is easily removed, and the heavier deposit of latex resulting from the coagulant film is removed from the vertical frame member and the U-shaped member. This scrap latex thus removed is a complete loss, but it is very small as compared to prior patents which have not proven commercially practical.

Reference is now made to the accompanying drawings, showing a preferred embodiment of the invention, in which:

FIG. 1 is a front elevation of apparatus for making latex surgical gloves;

FIG. 2 is an end elevation of the apparatus; and

FIG. 3 is an enlarged, longitudinal sectional view of a glove made by the apparatus and method of the invention.

The apparatus includes a coagulant solution tank 1 and a liquid latex tank 2, located in sequence adjacent to the discharge end of a preheat furnace indicated at 3. A horizontal conveyor, which may be in the form of a chain 4 as illustrated in the drawing, emerges from the

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preheat furnace 3 and is located above the tanks 1 and 2. Any suitable means (not shown) may be provided for continuously moving the conveyor chain longitudinally, at a constant speed, in the direction of the arrow shown in FIG. 1.

A supporting rail 5, which may be in the form of an H-beam, is located directly above and parallel with the conveyor chain 4 and forms a dual or double-sided rail for the rollers 6 of the trolleys 7 which are connected to the conveyor chain 4 at uniformly spaced intervals.

A link 8 depends from each trolley, being attached thereto as by a bolt 9, and a rack-supporting bolt or stud 10 is attached to the lower end of each link 8 in perpendicular relation thereto. Each trolley 7 upon the conveyor is adapted to carry a rack containing a plurality of forms, each rack being detachably connected to and suspended from the bolt 10 of the corresponding trolley.

Each of these racks comprises a vertical supporting frame member in the form of a vertical bar 11 having a loop or eye 12 at its upper end for detachable connection to the bolt or stud 10 of a trolley 7. A transversely disposed pin 13 is located through each vertical bar 11 at a point spaced below the loop or eye 12 and extends outwardly beyond each side thereof for a purpose to be later explained.

A U-shaped rod 14 is pivotally or hingedly connected to the lower end portion of the vertical bar 11. A horizontally disposed form-supporting plate 15 is attached to the end of each leg of the U-shaped rod 14 and a plurality of glove forms 16, of any usual and conventional construction and design, are rigidly attached to each of the supporting plates 15.

Although the drawing shows only eight glove forms mounted upon each rack, it should be understood that this is for the purpose of illustration only and that in actual practice a considerably greater number of forms is carried upon each rack, the only requirement being that an equal number of forms be carried by each leg of the U-shaped rod 14 so that the rack will be properly balanced in either the upright or inverted position of the forms.

A portable dipping machine, indicated generally at 17, is mounted for longitudinal movement adjacent to the tanks 1 and 2. For this purpose, parallel track rails 18 may be mounted upon the floor at one side of the tanks 1 and 2.

The dipping machine 17 is supported upon a platform 19 having flanged wheels or rollers 20 journaled thereon and mounted for rolling contact upon the track rails 18, whereby the dipping machine may be moved upon the rails to positions adjacent either of the tanks as desired.

An upright post 21 is mounted upon the platform 19 and has the perpendicular supporting members 22 and 23 extending forwardly from its upper end and from a point spaced from its lower end, to which supports is attached the vertical guide rod 24.

A head 25 is slidably mounted upon the guide rod 24 and adapted to be moved vertically thereon by the piston rod 26 of the fluid-operated cylinder 27. This cylinder is mounted upon the platform 19 as shown and is adapted to be controlled by a four-way valve 28.

An inlet pipe 29, leading from a pump or other source of fluid under pressure, is connected to the valve 28, and an outlet pipe 30 connects the valve to the return side of the pump. The valve is also connected by pipes 31 and 32 to the upper and lower ends of the cylinder 27.

Thus, by manipulation of the valve handle 33 the four-way valve 28 may be operated to admit fluid to either the lower or upper end of the cylinder 27 for raising or lowering the head 25 as desired.

A horizontally disposed tubular arm 34 extends forwardly from the sliding head 25 and a rod 35 is longitudinally slidably movable therein. A bifurcated mem-

ber 36, having notches 37 in its upper side, is fixed to the forward end of the rod 35 and a handle 38 is formed upon the rear end thereof for manually sliding the rod 35 within the tubular arm 34.

As shown in FIG. 1, the racks emerge from the pre-heat furnace 3 with the glove forms 16 suspended therefrom in inverted position with the finger-tips 39 of the forms disposed downward, as indicated at position A.

As also shown in FIG. 1, at position B, the dipping machine 17 has been moved to position adjacent to the coagulant tank 1. When a rack of forms has reached this position, the sliding head, carrying the horizontal arm 34, is first raised by operating the four-way valve 28 to admit fluid to the lower end of the cylinder 27.

As the arm 34 is raised, the notches 37 on the rod 35 engage the pin 13 on the vertical bar 11 of the rack, lifting the loop or eye 12 off of the bolt 10. The operator then pulls the handle 38 backward disengaging the rack of forms from the conveyor and supporting it upon the bifurcated member 36 of the rod 35.

The valve 28 is then operated to admit fluid to the upper end of the cylinder 27, lowering the head 25 and with it the rack of glove forms, at constant speed, dipping the forms, with the finger-tips down, into the coagulant solution to the depth shown at position B in FIG. 1.

As shown in FIG. 1, at this point the base or bottom ends of the forms are a short distance above the liquid level L of the coagulant, so that the entire forms, with the exception of this small portion at the base or bottom ends thereof, are coated with a film of coagulant. It will thus be seen that the supporting plates 15 of the rack and all portions of the rack above the liquid level L do not receive any film of coagulant.

The valve 28 is then operated to again admit fluid to the lower end of the cylinder 27, raising the forms at constant speed, with the finger-tips down, out of the coagulant tank.

The operator then revolves the U-shaped member 14 carrying the glove forms, around the pivot point thereof in the vertical bar 11, positioning the glove forms in upright position with the finger-tips 39 thereof up.

The dipping machine is then moved to position adjacent to the latex tank 2, positioning the rack of forms above the latex tank, and after a proper drying interval of the coagulant film on the entire forms, except the small portion at the bottom or base of each form, the valve 28 is operated to admit fluid to the upper end of the cylinder 27, to lower the forms, with the finger-tips up, at constant speed, into the liquid latex in the tank 2, entirely submerging the glove forms in the liquid latex.

After a proper dwell to permit the desired thickness of latex to be deposited on the forms, the valve 28 is again operated to admit fluid to the lower end of the cylinder 27, raising the forms out of the liquid latex at constant speed, with the finger-tips up.

The raising movement of the rack is continued until the loop or eye 12 thereof registers with the bolt 10 of the trolley 7, from which this rack was previously removed. By pushing forward on the handle 38, the loop 12 is again positioned around the bolt 10 and the valve 28 is then operated to admit fluid to the upper end of the cylinder 27 to lower the arm 34 sufficiently to disengage the notches 37 from the pin 13 so that the rack of forms is suspended by the loop 12 upon the bolt 10.

The operator then pulls the handle 38 backward to the position shown in FIG. 2 in order to clear the bifurcated member 36 from the path of the vertical bar 11 of the rack. The rack of latex-coated forms is thus suspended upon the conveyor chain as shown in FIG. 2.

The dipping machine is then moved back to position adjacent to the coagulant tank 1, in order to remove the next rack of forms from the conveyor and dip the same into the coagulant tank as above described, while the rack of latex-coated forms continues to move away from the tanks, as shown at C in FIG. 1.

It should be pointed out that the speed of the conveyor is timed so that an operator can go through the cycle of removing a rack of forms from the trolley, dip the forms in the coagulant, dwell, revolve the rack, dip the forms in the latex and then reengage the loop of the rack on the bolt of the same trolley from which the rack was removed, when that trolley has travelled the distance between two form-carrying trolleys.

As shown in FIG. 2, and at C in FIG. 1, each glove form, after dipping into the latex, has a film of latex of desired thickness as indicated at 41, over the entire form, except at the bottom or base thereof.

The base or bottom end of each form, which was not coated with coagulant, has a very thin film of latex, approximately .001" in thickness, as indicated at 42. The lower portion of the U-shape rod 14 and the lower end portion of the vertical bar 11, which were coated with coagulant prior to being dipped into the latex, are the only portions of the rack which have a relatively thick coating of latex thereon.

After the dipping operations above described, the conveyor carries the forms through the usual washing, drying and curing processes, after which the gloves are stripped from the forms. At this time the very thin deposit of latex at the very bottom of the forms and on the rack, and the heavier deposit of latex on portions of the U-shape rod 14 and vertical bar 11, are removed before repeating the dipping operations above described.

It will be seen that there is thus a minimum of latex wasted as scrap, requiring a minimum of time for removing the same. Since each rack carries a large number of forms, it will be seen that the amount of scrap and labor for removing the same, apportioned to each glove produced, is very slight.

As above pointed out, for the purpose of illustration only, eight forms are shown upon each rack, although in actual practice the number of forms carried by each rack would be considerably increased, whereby the amount of scrap apportioned to each glove would be materially reduced.

By dipping the forms into the latex with the finger-tips up, the tips remain in the latex for less time than the wrist portion, resulting in relatively thin tips and relatively thick wrist portions. In actual practice, surgical gloves are being produced in large quantities, upon apparatus embodying the invention, by applicant's assignee, The Massillon Rubber Company.

These gloves so made under the invention have a wall thickness of .006" to .007" at the finger-tips, as indicated at 43 in FIG. 3, and the wall thickness is uniformly tapered from the wrist portion 44, which is of greater than .010" thickness toward the finger-tips.

As shown in FIG. 3, the glove has no rolled edge or band at the wrist. Surgeons and nurses prefer this cut finish at the wrist, as the cuff lays flat on the sleeve of the operator's gown with no chance of rolling up caused by the bottom edge of the glove accidentally rubbing against the side of the gown or other object, as will happen with a rolled edge or band.

From the above it will be obvious that latex surgical gloves with relatively thin finger-tips and relatively thick wrist portions may be economically made on apparatus embodying the invention, with only a minimum of scrap.

Although the invention has been illustrated and described as adapted to the manufacture of surgical gloves, it should be understood that it is equally applicable to the manufacture of other latex articles where control of the wall thickness of various portions thereof is desirable.

In the foregoing description, certain terms have been used for brevity, clearness and understanding, but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiments of the improved construc-

tion illustrated and described herein are by way of example, and the scope of the present invention is not limited to the exact details of construction.

Having now described the invention or discovery, the construction, the operation, and use of preferred embodiments thereof, and the advantageous new and useful results obtained thereby; the new and useful construction, and reasonable mechanical equivalents thereof obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. The method of dip-coating a glove form having finger portions at one end and a wrist portion at its other end to produce a molded surgical glove having wall thickness tapered from the wrist to the finger tips, said method comprising the steps of dipping the form at constant speed in a vertical path only with the finger tips down into and out of coagulant solution to a point spaced from the wrist end, then dipping the coagulant-coated form at constant speed in a vertical path only with the finger tips up entirely into liquid latex, then removing the form from the latex at constant speed with the finger tips up.

2. Apparatus for making latex surgical gloves having wall thickness tapered from the wrist to the finger tips, said apparatus comprising a coagulant solution tank and a liquid latex tank, a conveyor moving horizontally above said tanks, a plurality of racks detachably suspended from the conveyor at spaced intervals, each rack comprising a vertically disposed bar, a U-shaped rod pivotally mounted intermediate its ends upon the lower portion of said bar, glove forms connected at their wrist portions to the ends of the legs of said U-shaped rod and having their finger tips located on the other side of said pivot point from said wrist portions, whereby the glove forms may be positioned with the finger tips either up or down, a dipping machine movable to positions adjacent each tank, a vertically movable head on the dipping machine, means upon said head for removing each rack from the conveyor and supporting it upon said head, means upon the dipping machine for moving said head vertically for successively dipping the rack supported thereon into and out of coagulant solution tank and into and out of said liquid latex tank, said means upon the head being adapted to be operated for removing each rack from the head and again detachably suspending it from the conveyor, whereby the forms may be dipped tips down into the coagulant solution tank and then rotated upon the racks and dipped tips up into the liquid latex tank.

3. Apparatus for making latex surgical gloves having wall thickness tapered from the wrist to the finger tips, said apparatus comprising a coagulant solution tank and a liquid latex tank, a rack comprising a vertically disposed bar, a U-shaped rod pivotally mounted intermediate its ends upon the lower portion of said bar, glove forms connected at their wrist portions to the ends of the legs of said U-shaped rod and having their finger tips located on the other side of said pivotal point from said wrist portions, means for moving said rack to a position above the coagulant solution tank, means for moving the rack downwardly and then upwardly in a vertical path at constant speed to dip said forms into the coagulant solution

tank, means for moving the rack to a position over the liquid latex tank, and means for moving the rack downwardly and then upwardly in a vertical path at constant speed to dip said forms into the liquid latex tank, whereby said U-shaped rod may be rotated upon said bar to locate said forms with the finger tips down for dipping into the coagulant solution and with the finger tips up for dipping into the liquid latex.

4. The method of dip-coating a glove form having finger portions at one end and a wrist portion at its other end to produce a molded surgical glove having wall thickness tapered from over .010" at the wrist to .006" to .007" at the finger-tips, comprising the steps of dipping the form in a vertical path only with the finger-tips down into coagulant solution to a point spaced from the wrist end and removing it from the coagulant with the finger-tips down, then dipping the coagulant-coated form in a vertical path only with the finger-tips up entirely into liquid latex, and then removing the form with the finger-tips up from the latex.

5. The method of dip-coating a glove form having finger portion at one end and a wrist portion at its other end to produce a molded surgical glove having wall thickness tapered from over .010" at the wrist to .006" to .007" at the finger-tips, comprising the steps of dipping the form in a vertical path only at constant speed with the finger-tips down into coagulant solution to a point spaced from the wrist end and removing it at constant speed from the coagulant with the finger-tips down, then dipping the coagulant-coated form in a vertical path only at constant speed with the finger-tips up entirely into liquid latex, and then removing the form at constant speed with the finger-tips up from the latex.

6. The method of dip-coating a glove form having finger portions at one end and a wrist portion at its other end to produce a molded surgical glove having wall thickness tapered from over .010" at the wrist to .006" to .007" at the finger-tips, comprising the steps of dipping the form in a vertical path only with the finger-tips down into coagulant solution to a point spaced from the wrist end and removing it from the coagulant with the finger-tips down, then dipping the coagulant-coated form in a vertical path only with the finger-tips up entirely into liquid latex, holding the form in the latex for a sufficient period of time to obtain the desired thickness of latex deposit thereon, and then removing the form with the finger-tips up from the latex.

References Cited in the file of this patent

UNITED STATES PATENTS

1,951,402	Gammeter	Mar. 20, 1934
1,952,935	Miller	Mar. 27, 1934
1,989,717	Szegvari	Feb. 5, 1935
2,683,263	Lenhart	July 13, 1954
2,683,286	Lenhart	July 13, 1954
2,731,668	Miner	Jan. 24, 1956
2,772,797	Schreck	Dec. 4, 1956
2,840,219	Mervyn et al.	June 24, 1958

FOREIGN PATENTS

1,136,587	France	May 15, 1957
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