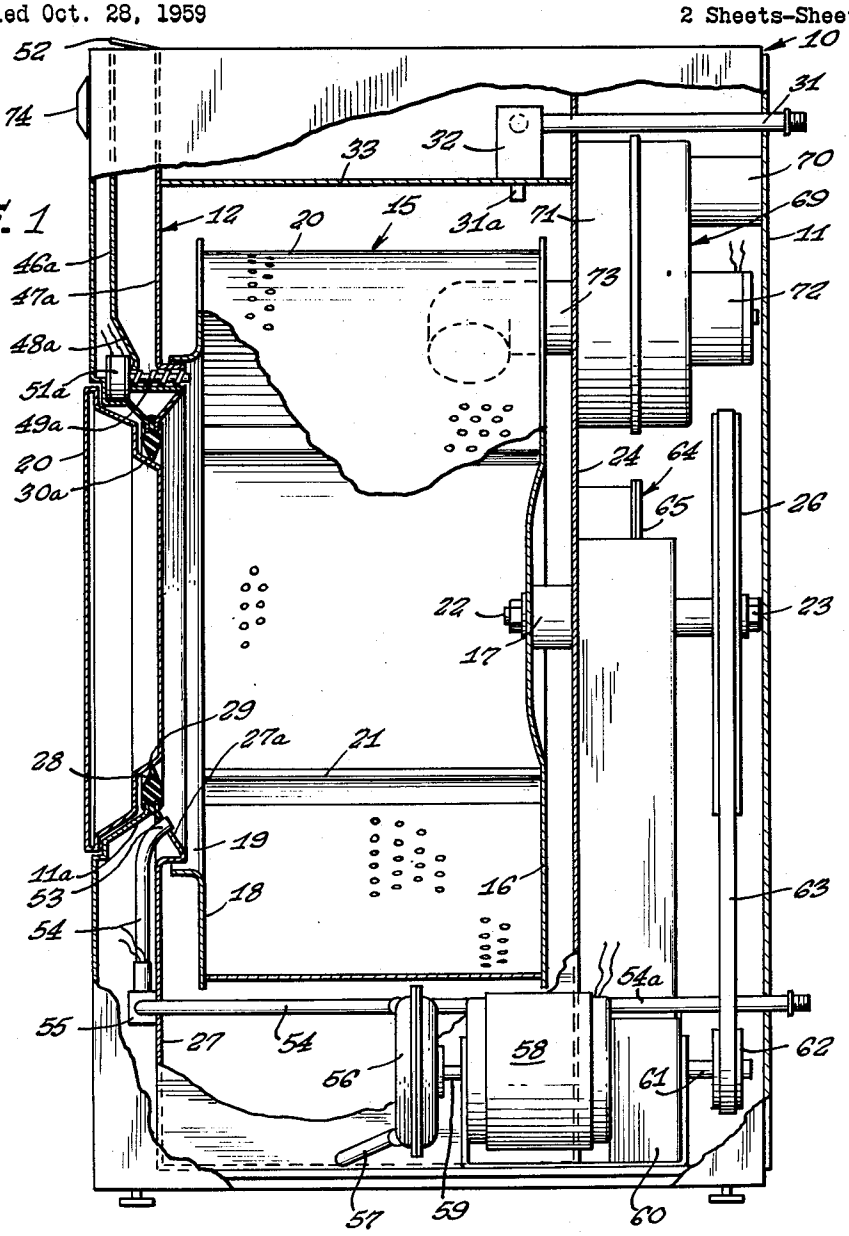
March 5, 1963 G. H. FREIER ETAL 3,080,252

METHOD OF CLEANING RUBBER ARTICLES SUCH AS GLOVES

Filed Oct. 28, 1959 2 Sheets-Sheet 1

Fig. 1



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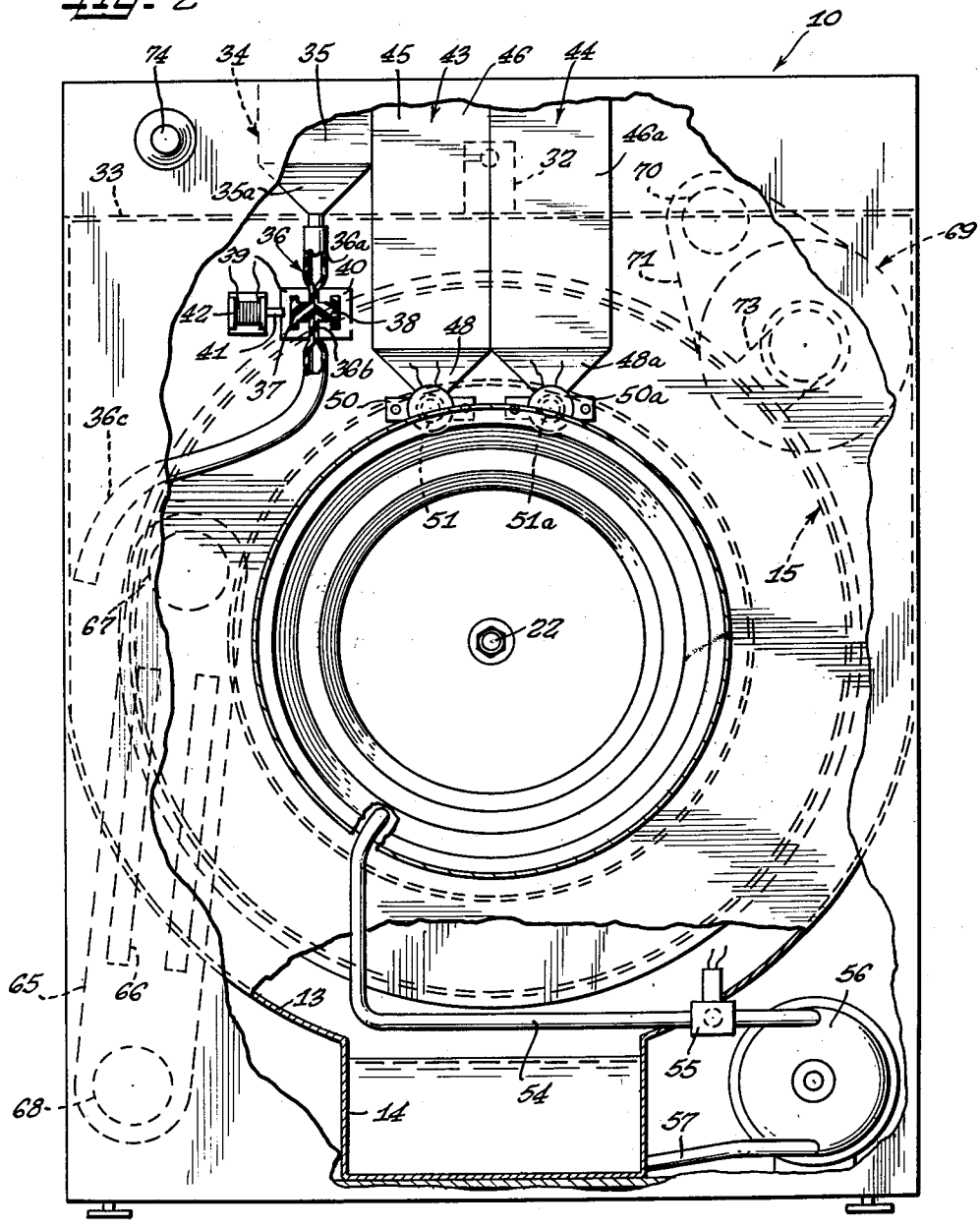
By Hill, Sherman, Meroni, Gross & Simpson Attys

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METHOD OF CLEANING RUBBER ARTICLES SUCH AS GLOVES

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Fig. 2



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3,080,252
METHOD OF CLEANING RUBBER ARTICLES SUCH AS GLOVES

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The present invention relates broadly to the cleaning of articles contaminated with pathogenic bacteria, and is more particularly concerned with a continuous process and apparatus for disinfecting, washing, rinsing and lubricating rubber gloves and similar articles.

The customary procedure in the cleaning of rubber gloves is essentially completely a hand operation from start to finish, requiring sterilization, washing, drying the outer surface, turning outside-in, drying the second surface and then powdering. Such a procedure may readily be recognized to be laborious and time consuming, and notwithstanding these important disadvantages, the steps described have destructive effects upon the gloves so that generally the life thereof is not more than two to three wearings. To eliminate certain of the handling in the washing and drying steps it has been proposed to launder the gloves in an automatic washer-drier; however, this technique is only a partial solution to the problem since the gloves must then be hand powdered and sterilized to render them suitable for re-use.

It is accordingly an important aim of the present invention to provide a method for cleaning bacteria-containing rubber articles, and which features the elimination of the excessive time and labor requirements named and which has no deleterious effects upon the physical properties of the rubber articles.

Another object of this invention lies in the provision of a method of cleaning rubber gloves and the like, comprising automatically and continuously disinfecting, washing, rinsing and powder lubricating the gloves.

Another object of the instant invention is to provide apparatus for cleaning rubber gloves and like articles, comprising an outer container and foraminous drum rotatable therein, means for injecting a stream of fluid into the drum for washing and rinsing the articles therein, means for directing a disinfecting fluid into the drum, means for injecting a powder lubricant into the drum, and means for selectively actuating the fluid injecting means, disinfectant directing means and lubricant injecting means whereby the articles are first disinfected and then washed, rinsed and lubricated.

A further object of this invention is to provide a method of cleaning rubber gloves and like articles, which comprises the steps of continuously contacting the articles with a disinfecting medium to destroy any pathogenic bacteria on the articles, discharging the disinfecting medium and any destroyed bacteria, contacting the disinfected articles first with a laundry fluid and then with a rinsing fluid, and applying to the laundered and rinsed articles a powder lubricant while the articles have rinsing fluid thereon to provide a powder residue sufficient to permit easy gloving on a powdered hand.

Other objects and advantages of the invention will become more apparent during the course of the following description, particularly when taken in connection with the accompanying drawings.

In the drawings, wherein like numerals designate like parts throughout the same:

FIGURE 1 is a cross sectional view, with parts shown in side elevation and with parts broken away, illustrating a laundry machine provided in accordance with the principles of the present invention; and

FIGURE 2 is a front elevational view, with parts

broken away and with parts shown in cross section, of the laundry machine of FIGURE 1, and showing particularly means for injecting a disinfectant, laundry medium and powder lubricant into said machine.

There is shown in the drawings and will be described herein a particular type of combination washer-drier apparatus which has performed particularly effectively in the practice of the method steps of this invention. However, it will be readily apparent to those versed in the art that other forms of combination machine may be employed when modified as taught herein. Further, while the invention will be described in connection with the cleaning of rubber gloves, it will be appreciated that other articles requiring the steps of disinfecting, washing, rinsing and lubricating can also be processed in accordance with instant teachings.

Referring now to the drawings, there is shown a laundry machine comprising a combination washer-drier indicated generally at **10**. While a machine of the character illustrated normally also performs extractor functions by use of spin cycles, it has been found desirable for the present purposes that fluid removal be effected by cycles of pump out and tumble. Specifically, spinning alone is not completely effective in removing water from within the glove fingers.

The combination washer-drier **10** comprises an outer shell **11** suitably finished to enhance the decorative appearance of the machine, and inside the shell **11** is a casing or outer container **12** of generally rectangular over-all configuration, but which is provided with a curved generally arcuately shaped bottom wall **13** and a sump **14** is provided at the bottom portion thereof subjacent a large hollow space enclosed by the casing **12**. This hollow space is herein characterized as a treatment zone in which the disinfecting, washing, rinsing, drying and lubricating operations are performed.

Carried within the casing **12** is a rotatable generally cylindrical foraminous drum **15** provided with a rear wall **16** connected to shaft support **17**, and a front wall **18** having a centrally disposed front opening **19**. A peripheral wall **20**, preferably foraminous, is disposed between the rear and front walls **16** and **18** and carries a plurality of circumferentially spaced radially inwardly extending ribs **21**.

The shaft support unit **17** includes a rotatable shaft **22** to which the drum **15** is firmly connected for corotation by means of a fastening nut **23**. The shaft unit **17** is supported in a rear wall **24** of the outer container **12**, and together therewith serves to support the shaft unit **17** by means of a bearing housing unit (not shown). Adjacent the free end of the shaft **22** is a pulley wheel **26** held in firm assembly with the shaft **22** by means of the fastener **23**.

The casing **12** has spaced away from the rear wall **24** a front wall **27** formed with an annular flange portion **27***a* cooperating with an annular flange portion **11***a* on the front wall of the shell **11** to mount an annular sealing member **28** defining an opening **29** lying generally in registry with the opening **19** in the drum front wall **18**. While the seal means **28** may of course take different shapes, the substantially tear-drop configuration shown works quite effectively.

The annular gasket **28** functions as a door seal, and for this purpose bears against an annular flange portion **30***a* formed on a door **30** mounted by suitable hinges (not shown) connected to the shell **11** or casing **12**. As is the practice, handle means and yieldable latch means are employed with the door **30**.

In order to charge the machine **10** with a supply of liquid, and in order to supply a stream of rinsing liquid into the treatment zone, a fresh water inlet **31** passes through and is supported by the rear wall of the outer

shell 11 and the rear wall 24 of the casing 12. The inlet 31 connects with a vacuum break means 32 supported by a transverse wall 33 extending between the casing front and rear walls 27 and 24, respectively. Liquid is discharged from the inlet nozzle portion 31*a* into the interior of the outer container 12 and is received in the sump 14 thereof for circulation into the rotatable drum 15.

In accordance with the principles of the present invention, means are provided for introducing into the rotatable drum 15 in contact with surgical rubber gloves or the like therein a predetermined quantity or volume of disinfectant at a particular concentration, as well as means for later introducing into said drum a laundry fluid and means for subsequently applying a lubricant to the disinfected, washed and rinsed gloves or other articles. The disinfectant introducing means is designated generally in FIGURE 2 by the numeral 34, and comprises a container 35 suitably supported by the outer container 12 and having a funnel portion 35*a* connecting with tube portion 36*a* of valve means 36. The tube portion 36*a* is constricted to a normally closed condition as indicated at 36*b*, and integral with the constricted portion 36*b* is a pair of tongue or key members 37 and 38 of generally T configuration recived in similarly shaped slots in a pair of plate members 39 and 40, respectively. The plate 40 may be stationary, while the plate 39 is free for movement and connects with a shaft 41 of a solenoid 42 wired into the electrical system of the machine 10, and particularly the timer portion thereof. As noted, the tube portion 36*b* is normally closed by formation of the permanent constriction therein, and an electrical signal to the solenoid 42 moves the shaft 41 and connecting plate 39 to the left as viewed in FIGURE 2, to open the tube portion 36*b* and permit the flow of disinfectant through tube portion 36*c* into the sump 14, so that the disinfectant may be diluted by water in the sump to avoid the possibility of damage to the rubber gloves or other articles, should a highly concentrated disinfectant be used. The tube portion or conduit 36*c* is of course attached to the inner walls of the container 12 by suitable means, which may include embossments, bracket means or the like.

The washing powder or detergent and the glove lubricant or talc are introduced directly into the rotatable drum 15, and for this purpose there is provided by this invention detergent introducing means identified generally as 43 and talc introducing means designated in its entirety by the numeral 44. With the exception of the materials dispensed thereby, the detergent and talc introducing means are identical in structure, and for this reason only the detergent dispensing means will be described in detail and like numerals with the suffix "*a*" have been appended to like parts of the talc introducing means 44.

The detergent introducing means 43 comprises a container 45 having a front wall 46, end walls (not shown), and a rear wall provided by wall portion 47 of the stationary front wall 27 of the outer container 12. The front wall 46 of the detergent container 45 is formed with an inwardly and downwardly sloping portion 48 providing a funnel or spout portion for the container 45, and washing powder or detergent directed thereby is conveyed into the interior of the rotatable drum 15 by action of feeder means 49*a* supported by suitable brackets 50 and driven by motor means 51. As is shown in FIGURE 1, the stationary front wall 27 of the container 12 is suitably shaped to receive the feeder means 49 and to provide a generally horizontal flow path for detergent from the container 45 into the interior of the drum 15 through the opening 19 therein. The motor means 51 is connected with the electrical system of the machine 10, and particularly with the timer portion thereof, so that detergent or talc are controllably admitted to the drum interior in accordance with a pre-set machine cycle. As FIGURE 1 illustrates, detergent or talc are admitted to the introducing means 43 and 44, respectively, through a loading door 52 formed in the top wall of the shell 11.

To complete the description of the apparatus, a liquid introducing means in the form of a nozzle 53 formed on a conduit 54 and supported by the wall 27 is provided to direct liquid from the sump 14 through the opening 19 in the drum front wall 18. As is appreciated, the liquid in the sump at different times may be water alone, a solution of disinfectant and water, or either laundry fluid or rinsing fluid. Within the conduit 54 there is located valve means 55 of the two-position type for controlling recirculation and drain, and the conduit 54 leads from the valve 55 to a pump 56 to which connects a conduit 57 providing an outlet from the sump 14, and through which suction can be drawn by the pump 56 to recirculate fluid from said sump and through the valve 55 and conduit 54 through the nozzle 53 and into the drum interior.

The pump 56 is driven by a motor 58 through a shaft 59, and as illustrated, the motor 58 may provide power for rotating the drum 15 through transmission means 60 and a shaft 61 supporting a pulley 62 about which is trained a belt 63 further trained about the pulley 26 on the shaft 22.

It is desirable as a step in the present method that the rubber gloves or similar articles be dried either subsequent to application of the powder lubricant, or dried initially to remove a portion of the rinsing fluid prior to contact of the gloves with the lubricant. The machine 10 herein disclosed accordingly embodies means to generate thermal energy, designated generally in the drawings at 64, and which may comprise a heater box or chamber 65 having heating elements 66 therein, the heater box 65 communicating with the interior of the container 12 and the treatment zone by means of a conduit 67 and receiving air from an intake 68. Air is drawn in through the intake 68 to be heated by the elements 66 and a forced air flow effected in the treatment zone by blower means designated generally by the numeral 69. The blower means may comprise an exhaust conduit 70 connecting with a fan scroll 71 which mounts motor means 72 and receiving an intake conduit 73 extending into the interior of the outer container 12. As is now apparent, air to be heated is drawn into the machine 10 through the intake 68 under action of the blower means 69, and said air is heated by the thermal elements 66 and passes into the treatment zone through the conduit 67 and is withdrawn from the treatment zone by the blower means 69, the air passing through the intake conduit 73, into the fan scroll 71 and through the exhaust conduit 70. The blower motor 72 is connected to the timer system of the machine 10 so that the blower is actuated only during the drying cycle of the cleaning operation, and similarly, the heating means 64 is electrically connected with the timer mechanism for actuation only during drying. The timer may of course take many different forms, and suitable timer means are indicated more or less schematically in the drawings by the numeral 74.

While exemplary operating conditions will be later described and a discussion given of specific examples of the novel results obtained, there will first be described generally a typical laundering sequence. Initially a quantity of contaminated rubber gloves or similar articles are placed within the interior of the drum 15 through the openings controlled by the door 30. Electrical controls for regulation of water temperature, and for control of the washing and drying cycles including the solenoid and motor means 42, 51 and 51*a* controlling disinfectant, detergent and lubricant flow from the containers 35, 45 and 45*a*, respectively, such as by the pre-settable sequential control means and selecting controls indicated generally at 74 so that no further manual intervention will be required.

The washing cycle is initiated by the introduction of a charge of water from the fresh water inlet **31**. The water enters the inlet **31** through an electrically operated thermostatically controlled mixing valve (not shown) of a type well known to those skilled in the art. The supply of water through the mixing valve is cut off when the level of the water in the sump **14** reaches a predetermined amount. A predetermined quantity or volume of disinfectant of a controlled concentration effective to destroy bacteria on the rubber gloves is introduced into the sump **14** from the container **35** under action of the solenoid means **42** which opens the normally closed constriction **36***b*. The motor **58** is then energized to rotate the drum **15** and to operate the pump **56** to direct a continuous stream of the disinfectant-water solution from the sump **14** through the conduits **57** and **54** and outwardly from the nozzle **53**.

After a predetermined disinfecting period, the disinfectant-water solution and destroyed bacteria are pumped from the sump through a conduit **54***a* to a drain outlet, the valve **55** having and being actuated to a drain position. Fresh water is again introduced through the inlet **31** to fill the sump **14** to the desired level, and detergent introduced into the tub interior from the compartment **45** by action of the feeder means **49** and motor means **51**. The pump **56** introduces the washing fluid from the sump **14** through the nozzle **53**, and upon completion of the time controlled washing cycle, the washing fluid is pumped out through the conduit **54***a* to the drain, and the tub **15** tumbled to remove the maximum quantity of wash water and suds. Fresh water is then again introduced through the inlet **31** and a rinsing cycle performed, which is followed by another pump out and tumble and a second clear water rinse, if desired.

An additional pump out and tumble is then employed. The drying step is then initiated, and during the first phase of the drying the motor means **51***a* and feeder means **49***a* under control of the sequential timing mechanism **74** are actuated to introduce lubricant from the compartment **45***a* into the drum **15**. During the initial phase of the drying step the exterior surfaces of the gloves are still wet, and when a powder lubricant is employed, a slurry is formed on the glove surfaces which distributes itself into the insides of the gloves during the tumbling and drying. As the drying step continues, the water is driven from the slurrry, and a dry powder lubricant is left on the glove surfaces as a residue. The residue has been found to be more than is generally accomplished by a manual hand powdering of individual gloves. After completion of the drying step and the lubricating action described, the gloves are then removed from the drum **15** and further processed as is customary practice.

At present the preferred disinfectant is sodium hypochlorite, and extensive investigations have been conducted establishing the relative compatibility of this compound with rubber gloves, as well as its effectiveness in destroying bacterial spores under various concentrations, contact times and temperatures. While the instant process effectively chemically sterilizes gloves contaminated with any pathogenic bacteria, including such resistant organisms as those responsible for anthrax, tetanus, gas gangrene, and botulism, the tests to be described were conducted using spores of *Bacillus subtilis* var. *niger*, recognized test organisms in work of this nature.

In these investigations wherein times were varied from zero to 35 minutes, temperatures from 45 to 160° F., and disinfectant concentrations from zero to 1000 p.p.m. sodium hypochlorite (as available sodium hypochlorite), it has been found that a desirable set of conditions is a concentration of 500 p.p.m. sodium hypochlorite, at 120° F., for ten minutes contact time. This provides a safety factor on all variables as follows:

Time—If 500 p.p.m. NaOCl and 120° F. are held constant, five minutes is sufficient time for sterilization.

Temperature.—If 500 p.p.m. NaOCl and 10 minutes and held constant, 75° F. is sufficient temperature for sterilization.

Concentration.—If 120° F. and 10 minutes are held constant, 100 p.p.m. NaOCl is sufficient for sterilization.

It may be seen therefore that if there is a failure in time of treatment to about one-half the recommended time, temperature of treatment to room temperature, or concentration of NaOCl to one-fifth the recommended concentration, sterilization will still be effected as long as the other two variables meet the recommended conditions.

The following examples will serve to illustrate the effectiveness of the present method in completely cleansing rubber gloves for re-use.

EXAMPLE I

Fifty pairs of surgical gloves were contaminated by dipping in an aqueous suspension of *B. subtilis* spores. Two independent replications were made. Total initial contamination level, based on rinse counts, was approximately 5×10^5 spores per glove. Gloves were allowed to air dry, and were then placed in the machine and run through the cycle described. Four gloves were removed and assayed by rinse counts for the presence of live indicator spores after each of the following cycles: 0 time, disinfect, final rinse, and end of dry. Samples of the drain water at the end of the disinfect and final rinse cycles were also assayed for viable spores after the disinfect cycle. No visible spores remained on the gloves, and no live spores were found in the drain water samples.

EXAMPLE II

An additional quantity of gloves were heavily smeared with canine whole blood on both sides and were allowed to dry overnight. The gloves were almost impossible to separate manually. After the complete described cycle in the machine, the gloves were entirely suitable for use.

EXAMPLE III

A quantity of surgical gloves were obtained from a veterinarian, and which were soiled with all materials normally encountered within general veterinary practice, as for example, blood, feces, hair, gangrenous material, grease, and the like. When cleansed in accordance with the steps of this invention, all gloves were found to be adequately sterilized and cleaned and entirely suitable for re-use.

EXAMPLE IV

Gloves were dipped into red blood cells contaminated with spores of *B. subtilis*, allowed to drain and dry for twenty-four hours, then turned outside-in and dried for an additional twenty-four hours before being cleansed in the manner herein described. The gloves so treated were washed clean, and could not be differentiated visually from clean control gloves. Sterilization was complete, as no spores could be detected on the gloves, in the wash water, or on the inside of the washer-drier.

In connection with the tests described above, air samples were also taken from the vicinity of the machine **10** during all stages of operation. It was found that all samples were negative for both vegetative and spore-type test organisms deliberately placed on the gloves.

It is of course appreciated that grossly contaminated articles may require some increase in the NaOCl used in the disinfecting step. The chlorine demand of several organic materials is given in Table A below.

Table A

CHLORINE DEMAND OF CERTAIN ORGANIC MATERIALS

Material	Chlorine Demand in mg./g. of Material	
	Wet Weight	Dry Weight
Whole blood, canine	2.9—	26.5
Dried peptone, Bacto		1.0
Casein, dried, vitamin free		18.4
Whole milk, homogenized	5.1	39.6
Egg albumen, raw	17.7	136.2
Egg yolk, raw	63.7	114.7
Glucose	0	0

The variation in the amount of chlorine is of course negligible except in severe cases. A concentration of 500 p.p.m. chlorine in 3.5 gallons (approximately 13.3 liters) results in 6650 mg. chlorine in the disinfect solution. It has been noted above that 100 parts per million (p.p.m.) of chlorine are sufficient to effect sterilization under the time and temperature conditions used in the machine **10**, that is, approximately 1330 mg. chlorine in the total disinfect solution. Based on a chlorine demand for canine blood of 26.5 mg. chlorine per gram of blood, it would take more than 200 grams of blood on the gloves to tie up sufficient chlorine to render sterilization ineffective.

A comparison has also been made of possible damage to rubber gloves by treating under the recommended conditions of 500 p.p.m. NaOCl for ten minutes at 120° F., as against damage when rubber gloves are treated by the standard steam sterilization technique using pressures of 15 p.s.i. at 250° F. for fifteen minutes. The test conditions used were to remove the fingers from the gloves and to cut the upper portion thereof in half. One-half of each glove was treated and the other half used as a control, in order to eliminate variability due to differences in individual gloves. The samples were treated for a total of 90 minutes, the NaOCl treated samples being removed and tested at ten minute intervals, while the steam sterilized samples were removed and tested at fifteen minute intervals. All samples were tested using ASDM designation B–412–51 T, which covers tension testing of vulcanized rubber. The gloves chemically sterilized for 90 minutes showed essentially no damage, whereas the steam sterilized gloves showed extensive and progressive damage after each sterilization period. The results obtained in these tests are set forth in Table B below.

Table B

RUBBER LIFE TESTS OF STERILIZED SURGICAL GLOVES

Sterilization Method	Number of Sterilization Cycles	Minutes Exposed	Percent Change of Treated Glove Area from Untreated Glove Area			
			Tensile Strength	300% Modulus	600% Modulus	Elongation
500 p.p.m. NaOCl, 120° F	1	10	±0	+2	±0	−2
	3	30	−21	−3	−3	−6
	4	40	−11	+3	−2	−1
	6	60	−5	+0	−1	±0
	9	90	−1	±0	−4	±0
15 p.s.i. steam, 250° F	1	15	−23	−18	−19	+2
	2	30	−16	−23	−36	+9
	3	45	−20	−22	−45	+11

Further tests have been conducted on the possibility of glove damage when the gloves are completely cycled through the steps of the method of the instant invention. Surgical gloves were run through thirty complete cycles, and in the first six cycles, the number of gloves was varied from fifty to one hundred pairs to determine the capacity of the machine. After cycle No. 6, the number of gloves was reduced to fifty pairs, and this was used as the optimum load for cycles 7 through 30. After each cycle, all

gloves were examined visually for percent sticking. After runs 2, 4, 15, 20, 25 and 30, gloves were tested in the same manner used to obtain the results set forth in Table B. No change in 300 percent modulus was noted, nor was there any change in 600% modulus or elongation through thirty runs. The tensile strength decreased slightly up to twenty runs, and showed no apparent change thereafter. Sticking was negligible, and the gloves were perfectly satisfactory for use after thirty runs. The results obtained are set forth in Table C below:

Table C

RUBBER LIFE TESTS OF SURGICAL GLOVES SUBJECTED TO EXTENDED TREATMENT IN THE WASHER-DRIER COMBINATION

Number of cycles [1]	Percent Change of Treated Glove Area from Untreated Glove Area			
	Tensile Strength	300% modulus	600% modulus	Elongation
2	−10	+13	−5	+1
4	−32	−4	−9	−2
15	−18	+3	−5	±0
20	−42	±0	−25	±0
25	−47	±2	−15	−12
30	−42	±0	−4	−9

[1] Each cycle included 10 minutes at 500 p.p.m. NaOCl at 120–125° F.

Those versed in the art will appreciate that water volumes and the time duration of the various steps of this process can readily be varied; however, in work performed to date and upon which the results above were based the following cycle was found desirable. The machine **10** was filled to normal fill level which brought approximately 13.5 litters of 120° F. water into the machine. 135 milliliters of Clorox compound (normally 50,000 p.p.m. NaOCl) was added to give a 500 p.p.m. disinfectant NaOCl solution. The gloves were cleansed in this solution for ten minutes, and the temperature was controlled to provide a maximum of 129° F. The disinfect period was followed by one minute of pump out and tumble, and thereafter the sump was filled to normal level, and a low sudsing detergent was added to make a 0.2% solution (27 grams) by weight. The gloves were detergent washed for five minutes with the temperature reaching a maximum of 123° F. This wash and disinfect cycle was sufficient to wash and completely turn partially inverted gloves. The wash cycle was followed by a two minute pump out and tumble cycle to remove as much wash water and suds as possible.

The cycle was continued by rinsing the glove for two minutes in clear 110° F. water followed by a one minute pump out and tumble and another one minute clear water rinse. Thereafter a two minute pump out and tumble was used to insure that the gloves were emptied of water collected on the finger tips. The drying cycle was then initiated, and during the first ten minutes of the cycle the exterior surfaces of the gloves were wet. During this ten minute period the gloves were sprinkled with talc, approximately 50 grams being sufficient. The drying step was continued to completion for a total of 45 minutes which is normally sufficient to dry the gloves after powder lubrication in the wet stage. For a total of fifty pairs of gloves in the machine **10**, a disinfect, wash and rinse cycle of 24 minutes as described removes such difficult materials as animal fats and alcohol dried blood stains, and for this same load, the forty-five minute drying cycle produces the desired results.

It may now be seen that by proceeding in accordance with the novel concepts herein disclosed there are obtained numerous and substantial advantages over the earlier methods of cleansing rubber gloves and like articles. There is provided a fully automated method performed in a single machine of known construction modified in accordance with the principles of this invention to

incorporate the disclosed novel elements which coact with the known elements to produce a new combination.

Substantial time savings are effected by the instant method and disclosed apparatus, these savings being generally of the order of 75%. Specifically, when rubber gloves are washed by hand, about 85 seconds per pair are required to collect, sterilize (autoclave), wash, rinse, dry the outer surface, turn outside-in, dry the second surface, powder and return the gloves to the point of reuse. In addition, facilities for drying gloves must be provided. By way of contrast, employing the present method requires only about 20 seconds per pair of gloves to handle, wash, sterilize, dry, powder and return the gloves to the re-use point.

In addition, the usable life of the gloves is substantially increased by this invention. It has been earlier noted that gloves cleansed by the present method were perfectly satisfactory for use after thirty runs, and at this point the tests were discontinued because it was felt that this was beyond the normal expected life, due to anticipated damage from other than sterilization or washing. However, when gloves are hand cleansed by the earlier methods, the life of the gloves is generally not more than three re-uses. It may accordingly be anticipated that substantial reductions in rubber glove requirements for hospitals, laboratories and the like will be effected, and from experience to date this reduction is believed to be of the order of 80%.

Rubber gloves processed through the steps of this invention are uniformly satisfactory from all standpoints, in that the gloves are clean, free of pathogens, dry and powdered lightly. In fact, the degree of powdering is such that no additional talc is required to glove easily the powdered hand.

It is to be appreciated that various changes and modifications may be effected in the process and apparatus herein disclosed without departing from the novel concepts of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of cleaning rubber articles such as gloves which comprises the steps of confining the articles in an enclosed treatment zone while subjecting the same to a continuous series of separate steps in a programmed sequence including,

wetting said articles with a liquid disinfecting medium to destroy any pathogenic bacteria on said articles,

removing and discharging said liquid disinfecting medium and any destroyed bacteria from the treatment zone,

thereafter washing and rinsing said articles first with a laundry liquid and then with a rinsing liquid,

preliminarily drying said articles to remove a portion of said rinsing liquid thereon but leaving said articles in a semi-wet condition,

injecting into the treatment zone while said articles are in said semi-wet condition a powder lubricant to form a coating of lubricant slurry on the surfaces of said articles,

and thereafter removing moisture from the slurry and the treatment zone to leave a powder residue of said lubricant on said surfaces of said articles in sufficient quantity to render unnecessary subsequent powdering of said articles prior to the normal use thereof.

2. A method of cleaning rubber articles such as gloves, which includes the steps of confining said articles in a treatment zone,

wetting the confined articles with an aqueous solution of disinfectant to chemically sterilize said articles,

removing said aqueous solution of disinfectant from the treatment zone,

agitating said articles in the treatment zone in the presence of a laundry liquid to wash the articles,

draining the laundry liquid from the treatment zone,

rinsing the articles with a rinsing liquid in the treatment zone,

partially drying said articles to remove only a portion of said rinsing liquid but leaving the articles in a semi-wet condition,

applying to said semi-wet articles in the treatment zone a powder to form with the remaining portion of said rinsing fluid an aqueous slurry of said powder on the surfaces of said articles,

and completing the drying of the articles in said treatment zone to remove the moisture from the slurry and leaving a powder residue having lubricating properties on the surfaces of the articles.

3. A method of cleaning rubber gloves and like articles located in a single treatment zone which comprises the steps of

continuously and sequentially contacting said articles with a liquid disinfectant,

laundry liquid,

and rinsing liquid,

and while said articles are in said treatment zone with at least a portion of said rinsing liquid thereon,

applying to said articles a powder lubricant to provide on said articles a slurry of said powder and said rinsing liquid

and thereafter drying said articles while in the treatment zone to leave a powder residue on the articles rendering said articles suitable for normal use without additional powdering.

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