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First inventor	Sokolov
Title of invention	Pneumatic device removing disposable glove
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Abstract

Replacing disposable medical gloves is difficult and unsafe to handle. It is necessary to remove the glove from the hand in such a way as to avoid contact with the contaminated area. In this case, the infected area is usually not identified visually, and medical personnel are forced to be guided only by their own memory and imagination. Getting rid of disposable gloves in itself is a complex procedure that requires attention and training. Given the long work of medical personnel in a dangerous and infected area, this can ultimately lead to mistakes, and the constant fear of these mistakes should cause stress. Thus, the removal of disposable medical gloves, which is now practiced, is a constant psychological burden on the medical staff, and in case of negligence and reduced attention, the danger of the spread of infection. The very process of storing and disposing of used medical gloves is in no way satisfactory, since it is practically very poorly controlled.

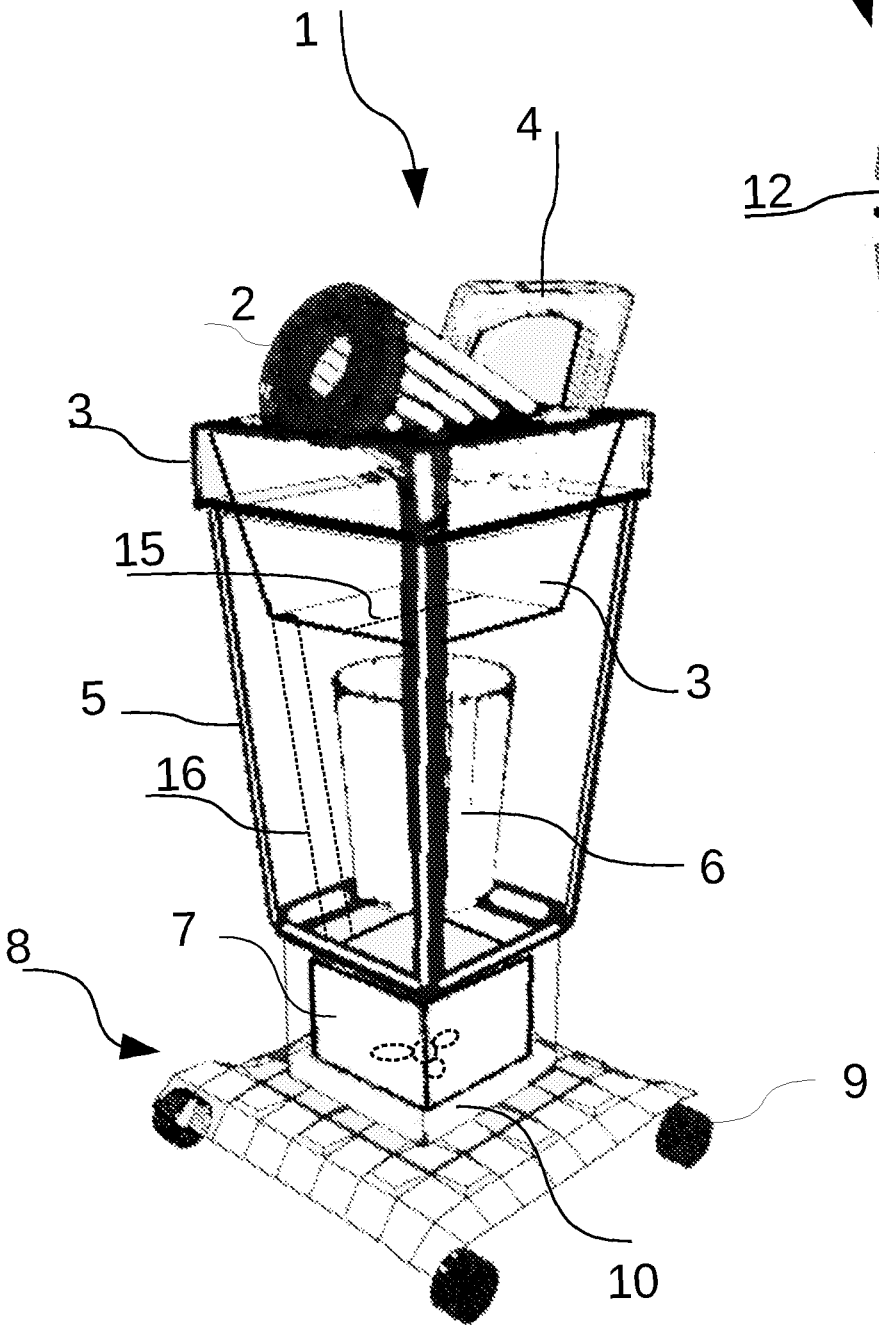

Fig.1

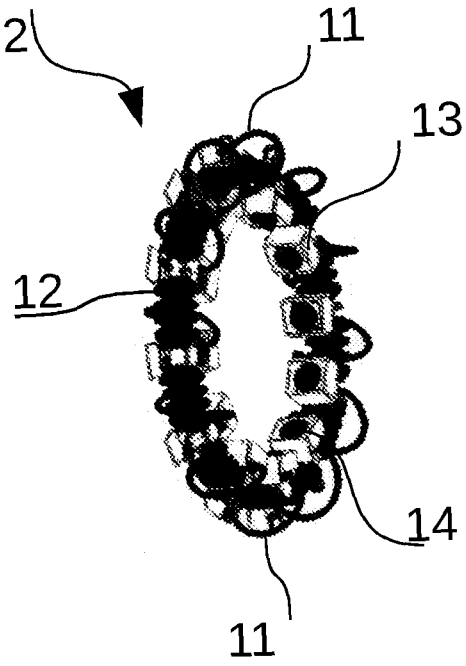

Fig.2

Pneumatic device removing disposable glove

Background

The task of the device proposed here is to safely remove disposable medical gloves from the hand without requiring intense attention of personnel. Previous solutions in this area of sanitation have primarily provided devices for putting gloves on the hand. (Patent US4915272A) But this process is not so important, since it is not associated with stress and the danger of infection. Solutions related to the removal of the glove from the hand were presented by the inventors as additional and were presented by them as simply the reverse process. At the same time, the devices themselves looked very cumbersome, representing a kind of laboratory furniture. The difference between the solution proposed here is mobility, since the entire device can be easily moved to the patient's place as needed and returned back. Another important difference is the use of the bracelet. This bracelet consists of suction cups interconnected by pneumatic drives. The working area of the device is a bracelet and a container that resembles a conventional container for medical waste. Also, the device must have a fan at the bottom that creates negative pressure. The device is mounted on wheels and supplied with handles, which would be convenient to move around the entire territory. Negative pressure is not the main operating factor here, as in other previously submitted patents. These patents, as already mentioned here, have the main purpose of putting a surgical glove on the hand. At the same time, the decisions of how the hand will be removed from the area of reduced pressure are very controversial if the wrist area has to be sealed. Here this problem is solved by a bracelet with suction cups and actuators. Such a bracelet for a similar purpose can be used separately, as well as used in other devices such as laboratory glove boxes.

Summary

The very procedure for removing the glove from the hand does not require any other action, except for placing the hand in the working niche of the device. The bracelet is located in this niche. The diameter of the bracelet without air pressure in pneumatic actuators should be approximately equal to the diameter of the wrist. When performing such working operations as placing a hand in a niche, the diameter of the bracelet increases due to the action of pneumatic actuators. Then the pressure in the actuators drops and the bracelet fits around the wrist. After that, the vacuum on the suction cups starts to work, and the bracelet is attached to the rubber glove. This creates a basic working position. The bracelet is fixed at the top of the removable part of the device, which together is a separate working unit. The task of this working unit is to remove the glove from the hand. Below this detachable work unit is a storage for already removed gloves, and the fan and a chassis on wheels. When the pneumatic actuators receive pressure, the bracelet expands again to a big diameter, the edges of the bracelet should be in tight contact with the edges of the working niche. This creates a closed container where negative pressure can be generated. For this, an air line from the fan must be connected to this working unit. The work of the bracelet is to grab a part of the glove on the wrist with the suction cups, while the pneumatic actuators begin to stretch the glove until the size increases to the above state. The negative pressure generated by the fan will then inflate the glove. The hand can then be easily and safely removed. The suction cups will then release the glove and it will be sucked by negative pressure into the lower part, where it will then be kept along with the others and disposed of. The bottom flaps of the work unit should open and close as the glove, removed from the hand, enters the wast box. The device software should include not only microcontroller control, but also the ability to connect devices to a common network. Thus, all information on all used disposable gloves, for example, within one hospital, will become available.

The bracelet itself has two circular air lines, one as the main one spreads positive pressure through and the other is vacuum. The vacuum works in the suction cups allowing them to catch and grip the edge of the rubber glove on the wrist area. Positive pressure expands the bracelet by increasing its diameter using soft shell actuators. The design of the bracelet is block or modular. Pressure or vacuum is passed through each such block through the connecting tubes. In this case, the tubes through which the vacuum flows are in the form of a spring coil. Each block or module consists of one suction cup and one actuator. Each of the two rings obtained in this way requires a separate vacuum or positive pressure. This is done using micro pumps through air receivers and a valve system. The valves should be located with such logic that it would be possible to change the pressure to vacuum and vice versa in both rings. This is necessary so that the suction cups can be blown to clear out in the system, or additionally squeeze the bracelet for a better fit to the wrist. Since the girth of the wrist is different for everyone, the more different male and female (about 30 mm), the size of the bracelet should be such that it would fit freely on the wrist. This will be the position at which the pressure in the actuators will be equal to atmospheric. However, the soft shell will allow the actuator to shrink to a smaller size. For this, negative pressure will have to be applied to the system. It is also obvious that the suction cup may be unevenly adhered to the surface of the glove due to debris, folds and irregularities. In order to somehow reduce this negative factor, the suction cup must first apply positive pressure upon contact with the surface, which will partially smooth out the adhesion surface and get rid of debris under the suction cup. Thus, a jumper with a valve will be installed between the air lines with positive and negative pressure. However, in any case, the problem is that during the operation of the bracelet, not all suction cups can attach equally well to the rubber of the glove in order to create the desired effect. That is, air can still leak through some of the suction cups, which can lead to a general depressurization, as a result of which the glove will not be grabbed and simply fall off. To prevent this from happening, each suction cup must be equipped with its own

separate valve. This valve will automatically close when there is a differential pressure, maintaining the required vacuum inside the suction cup and, upon further action, will open by an electromagnetic or some similar mechanism. To control the operation of such a valve, it is desirable to have the necessary sensor, preferably a Hall sensor. Each module will also be additionally equipped with the following sensors. It is a capacitive sensor that indicates contact with human skin. This also requires a voltmeter to distinguish this contact. Since rubber is a dielectric, and human skin has a certain resistance, a voltmeter is good at detecting the presence of a glove or unprotected hand skin. If contact with bare skin is detected, the system should raise an alarm. For this, LEDs will be located in a convenient place for observation of the module. There are at least two LEDs - red and green. Red is for alarm, green indicates normal contact. It is also possible to use an audible warning signal. All the electronics necessary for this, together with the microcontroller, will be placed on four PCBs connected by cables so that all this will form an external box around the suction cup module. This arrangement is convenient in that it provides the maximum area on the PCB surfaces for the location of all electronic components. This will also facilitate the assembly of the entire working module of the suction cup, since the box will act as an outer shell or frame. There are electronics verification test will also mean that all the physical structural parts of the vacuum mechanism are installed correctly. The diameter of the suction cup itself should not be large, so that the skin is not caught along with the rubber. Also, the small dimensions of the entire assembly are necessary for ergonomic reasons. Thus, all the parts of the vacuum mechanism must have a miniature character, which will require great care during assembly.

Drawing

Fig 1. The pneumatic device (1) has a bracelet(2) mounted in the niche of the upper working unit(3). The device itself resembles a conventional medical waste container mounted on a movable platform (8) and having a handle(4). The fixed part of the device is formed by a container body(5), a fan(7) and a mobile platform(8) with wheels(9). Replaceable items include a container for storing dirty gloves (6) and biological filters under the fan(10). Negative pressure is piped(16) to the upper working assembly when the glove needs to be inflated to remove it from the hand. The lower flaps(15) of the upper working unit will open so that the glove removed from the hand falls into the waste container.

Fig. 2. The bracelet(2) consists of the following parts. This is a system of tubes(11) through which vacuum is supplied to suction cups(14) and pneumatic actuators(12). The sensors are located on PCB(14) that form a box or shell around the suction cup modules.

Doc Code: CV19.PUB.PRO
Document Description: COVID-19 Collab Database Request for Prov Appl

PTO/SB/452 (09-20)

CERTIFICATION AND REQUEST FOR COVID-19 PROVISIONAL PATENT APPLICATION PROGRAM

(Page 1 of 1)

First Named Inventor:	Serge Sokolov
Title of Invention:	pneumatic device removing disposable glove
Contact information to include in database (optional)	23 Lahtinska 18 St. Petersburg, Russia sergesclv@gmail.com

APPLICANT HEREBY MAKES THE FOLLOWING CERTIFICATIONS AND REQUESTS THAT THE USPTO INCLUDE THE DESCRIPTION OF THE ACCOMPANYING PROVISIONAL PATENT APPLICATION IN A PUBLIC DATABASE.

1. The description of the accompanying provisional patent application concerns a product or process relating to COVID-19 and such product or process is subject to an applicable FDA approval for COVID-19 use.

2. The accompanying application is in the English language.

3. The accompanying application is being filed in DOCX format via the USPTO's Patent Center filing system, together with this form.

4. The applicant understands that while the required filing fee for the accompanying provisional application may be deferred by acceptance into this program, the appropriate filing fee must be paid in order for a subsequent U.S. nonprovisional application to claim the benefit of the filing date of the accompanying provisional application. Applicant recognizes that the filing fee due in the future may be more than the current fee due and that by deferring payment of the filing fee, there may be an increase in the total fee due.

5. Applicant authorizes and requests that the description, including the specification and any drawings, claims and/or abstract of the accompanying provisional patent application, as well as this form, be included in a searchable online public database.

6. Applicant understands that inclusion in the public database is a publication of the description and this form.

Signature /Serge Sokolov/	Date 08-26-2021
Name (Print/Typed) Serge Sokolov	Practitioner Registration Number

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.**

■ *Total of 1 forms are submitted.

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