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Battling Covid-19 with Foot-Operated Sanitizer Dispenser Stands

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Abstract - *Sanitizers remove bacteria from the surface up to a certain safe level. Hand sanitizers consist of foam, gel, liquids, etc. which help in the reduction of harmful bacteria present on hands. During the recent outburst of the global pandemic of COVID-19, sanitizers have proven to be the greatest shield against the virus, as various studies have shown that the corona virus is rendered inactive by the use of sanitizers. However, there is still a risk of contracting the virus in public places, where many people touch the same sanitizer bottle. The virus can easily spread from one person to the other, if a person who is a carrier of the virus touches the sanitizer bottle. The foot-operated sanitizer dispenser totally eliminates the use of hands required for pushing the sanitizer bottle pump. The main aim of this paper is to explain the various aspects of a basic foot- operated sanitizer dispenser which include its mechanism, parts, construction, costs, materials, working etc. Also it suggests various modifications in the basic model that can be implemented to make the dispenser stand more convenient and adaptable.*

Key Words: COVID-19, Hands-Free, Foot-Activated Lever Mechanism, Sanitizing, Disinfectant, Corona Virus.

1. INTRODUCTION

Contactless technology is the need in this COVID-19 pandemic. Corona virus spreads when an infected person comes in contact with other people and this chain continues. Although sanitizers help by preventing the spread of this virus, there is always a risk when the same bottle is touched by an infected person as well as other people. So in this case any mechanism that may help to avoid hand contact with the sanitizer bottle and at the same time is cheap and durable would be helpful. The foot-operated sanitizer dispenser is recently gaining popularity as it is further safe-guarding people against the corona virus. This machine is totally hands free, hence preventing the spreading of germs/viruses through touch. This dispenser is usually placed in hospitals, offices and other public places. For using the foot-operated sanitizer dispenser, the user needs to press the pedal by using his/her foot and place his/her palms in front of the sanitizer bottle. A small amount of sanitizer automatically gets dispensed into the palms of the user on pressing the pedal. This invention thus prevents spreading of the virus due to its complete hands-free operation.

2. Basic Mechanism

The mechanism used in this product is known as Foot-Activated Lever Mechanism. In this mechanism, a great amount of force can be produced by applying a small amount of force by human foot on a pedal. On pressing the pedal, the entire mechanism gets linked and the mechanism is activated. The mechanical energy released after the activation, results in a linear motion in the top part of the product. This up and down motion thus presses the pump present in the sanitizer bottle, and sanitizer is dispensed. For the optimal performance of the foot-activated lever mechanism, several factors need to be considered:

1) The relation between foot and the fulcrum position.
2) The dimensions of foot.
3) The relation between the linkage points of the pedal and the application points of force exerted by foot.
4) The amount of force applied against the pedal movement.

3. BASIC MODEL OF FOOT-OPERATED SANITIZER STANDS:

3.1. PARTS:

1. Base

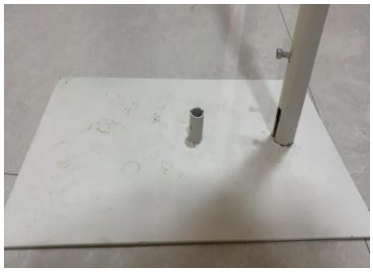

Fig (1)

Dimensions: 350 x 210 mm, thickness= 3mm
Materials: Hot rolled metal sheet, 50 Rs/Kg
Cost: Rs.90
Function: Base is one of the most important parts of this dispenser. It bears the entire weight of the machine. The base also provides a steady balance to the stand.
Features: The Base should be totally flat to provide stability to the entire system. Also, as the base is always is always in contact with the ground, it is prone to corrosion. Hence a coat of corrosion resistant paint must be applied to the

based. To increase the firmness of the base, it can also be bolted to ground.

2. Pedal

Fig (2)

Dimensions: width=32mm, height=15mm, length=20mm, thickness=12 mm
Material: CRCA (Cold Rolled Close Annealed) Square Metal pipe, 60Rs/Kg
Cost: Rs. 15
Function: Pressing the pedal triggers entire mechanism
Features: The pedal must be able to withstand the amount of force applied by the user. Also, the pedal forms an integral part of the foot-activated lever mechanism.

3. Inner Fixed and outer movable pipe

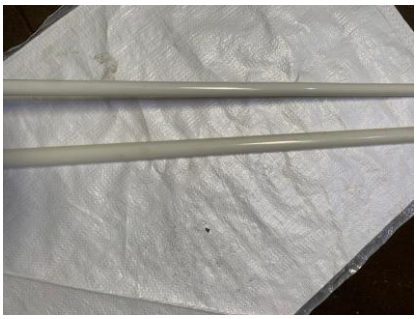

Fig (3)

Dimensions: Inner pipe diameter- 19mm, Thickness- 2mm, Length-965mm, Outer pipe Diameter- 25.40mm, Thickness-1.5mm, Length- 910mm

Material: CRCA Tube (Metal coil), 60Rs/Kg
Cost: Cost of both pipes Rs. 90
Function: The inner fixed pipe acts as a supporting pillar to the outer pipe and is also an important part of the mechanism. The outer movable pipe is where the base of the sanitizer bottle is attached. The outer movable pipe follows a linear up and down motion.

Features: As the outer pipe moves in a linear motion, precautions should be taken so that forming of friction between the inner pipe and outer pipe does not occur. Also, corrosion resistant paint must be applied to both the pipes.

4. Sanitizer bottle base

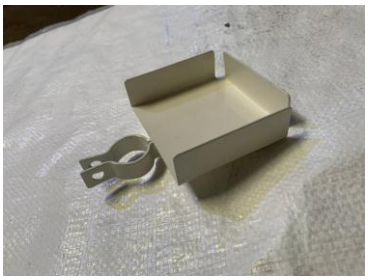

Fig (4)

Dimensions: 100 x 90mm. The wall base is raised to 25mm, it is bent by forming.
Material: Metal sheet
Cost: Rs. 10
Function: This base holds the sanitizer bottle.
Features: Base should be adjustable by height.

5. Top constraint part

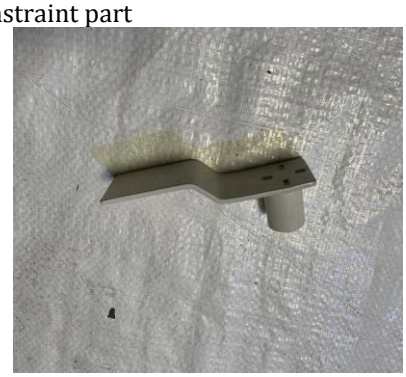

Fig (5)

Dimensions: Lower Circular Part diameter- 22mm, thickness- 5mm, length- 25mm; Extended Par- 135 x 30 mm, thickness-3mm
Material: Metal Sheet
Cost: Rs. 6
Function: Lower Circular Part- This part restricts the motion of the outer movable pipe. Extended Part-
It acts as a constraint for the upward motion of the sanitizer bottle.
Features: Lower Circular Part-Diameter of this part should almost be equal to or greater than the outer pipe so as to restrict its motion. Extended Part- This Part must be welded to the lower circular base with utmost precision.

6. Spring

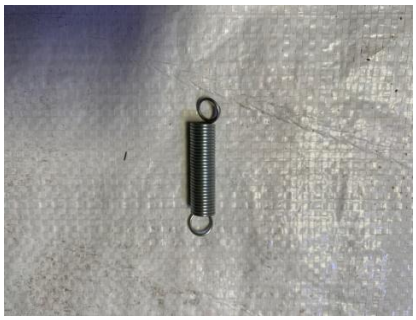

Fig (6)

Dimensions: diameter- 12mm, length- 35mm
Material: Steel
Cost: Rs. 10
Function: function of the spring is to bring back the outer pipe to original position
Features: the length of the spring should be chosen carefully according to the mounting points.

7. Clips(2)

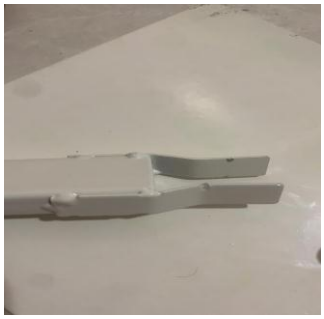

Fig (7)

Dimensions: Per clip: Length- 70mm, Width- 15mm, thickness- 2mm. It is bent by forming process.
Material: CRCA Metal Sheet
Cost: Rs 2
Function: Clips are bent by forming process to use them as connecting link between the pedal and the inner fixed pipe.
Features: The final distance between the clips, after it is bent by forming, should not be more than the diameter of outer movable pipe.

3.2 CONSTRUCTION:

1. The preliminary task is to the make base flat. The sturdier the base, the more strength it has for holding the entire mechanism. [Fig (1)]
2. Then, the inner fixed pipe should be welded to the base.
3. The next step is to form a socket of diameter 16mm, thickness 1.5mm and height 30mm from a CRCA Metal Coil. [Fig (1), Fig (8)]
4. This small pipe is used as a paddle socket on which the paddle is mounted and it is welded onto the base with the center-to-center distance between the inner fixed pipe and this short pipe being 110mm. [Fig (8)]
5. Clips formed earlier are welded one end of the pedal to link the pedal to the inner fixed pipe. [Fig (12)]
6. A hole of 16.5mm diameter is drilled on the pedal. The distance of the hole from the other plain end of the pedal is taken in such a way that after the pedal is linked to the inner fixed pipe through the clips, the pedal socket should fit in that hole drilled on the socket .The mechanism is shown in [Fig (12), Fig (9)].
7. The pedal is then fixed on the short pipe and the inner fixed pipe. [Fig (9)]
8. The sanitizer base is attached onto the outer movable pipe with the help of clips. [Fig (4)]
9. Two screws, one on each, are attached on the inner fixed pipe and the outer movable pipe. The screws are used to hold the spring. The distance between the screws on the two pipes should be chosen in such a way that the spring should remain in a compressed position initially. [Fig (10), Fig (11)]
10. The outer movable pipe is placed upon the inner fixed pipe and the spring is attached.
11. Finally, the top constraint part is attached upon the inner fixed pipe. [Fig (5)]

Fig (8)

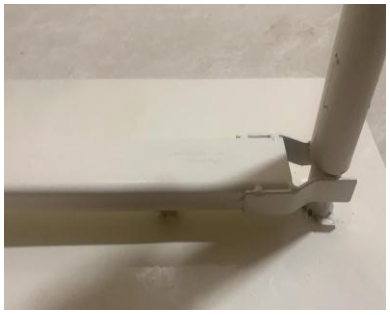

Fig (9)

Fig (10)

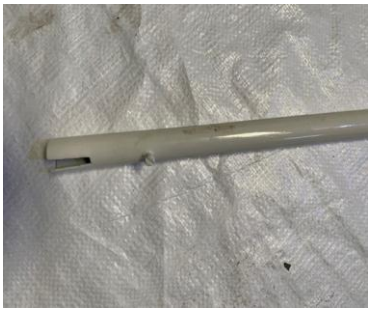

Fig (11)

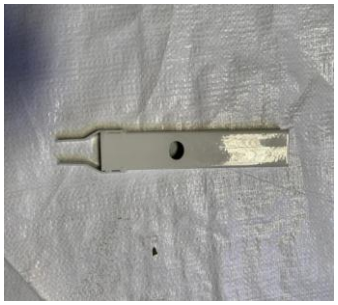

Fig (12)

Fig (13)

3.3 WORKING:

1) On pressing the pedal, the clips attached to the pedal and inner fixed pipe make similar movements as the pedal.
2) The outer movable pipe, which was earlier resting on these clips, shoots upward due to the movements generated by the pedal and the clips.
3) As the outer movable pipe moves upwards, the sanitizer bottle, placed inside the sanitizer bottle base, reciprocates with the outer movable pipe.
4) This upward movement of the outer movable pipe is terminated by the top constrained part.
5) The lower circular base prevents the ascending movement of the outer movable pipe; also, at the same time the extended part of the lower circular base clashes with the sanitizer bottle pump.
6) Hence, pressure is applied on the pump and the bottle starts dispensing sanitizer.
7) The dispensing action of the sanitizer bottle comes to an end when the pump is brought back to its original position by removing the pressure applied.
8) For this action to take place, the outer movable pipe should move downwards, thwarting the collision between the bottle and the extended part of the lower circular part.
9) When the pressure from the pedal is lifted, the pedal returns to its original position, so does the clips and outer movable pipe. Thus, the pump returns to its initial position and stops dispensing sanitizer.
10) However, in certain cases, the pedal remains in a neutral position on the removal of pressure.
11) In order to bring the outer movable pipe downwards, and to stop the dispensing action, the spring mechanism takes place.
12) When the outer movable pipe shoots upwards, the spring attached to the outer movable pipe and inner fixed pipe gets extended / elongated.
13) As the collision between the outer movable pipe and the top constraint occurs and there is no scope for the pipe to move further upwards, the extended spring pulls the pipe back to its initial position, so that it can return back to its compressed state.
14) Hence, the dispensing action stops.

3.4 SPECIFICATIONS:

Table -1:

Characteristics of model	Value
Total weight	3.80 kg
Total height	970 mm
Total estimated cost	Rs. 350
Durability	10 years
Cost of powder coating	Rs. 55
Time required for manufacturing	4 hours

3.5 ADVANTAGES:

1. The most significant advantage of foot-operated sanitizer dispenser is the hands-free usage. The spreading of germs / viruses by means of touching the pump of sanitizer bottle by a large amount of people is almost reduced to zero by means of this dispensing machine.

2. This machine is user-friendly. This machine does not require any high-end skills nor does it require massive amount of strength for operation purpose.

3. Almost all parts required for the manufacturing of this dispenser can be obtained from the industrial waste discarded by fabrication, construction, production, manufacturing factories.

4. This machine is portable and does not require much space. It can easily be placed in cramped-up places.

5. This machine entirely works on mechanical mechanism. It does not require any power source or battery cells for operation.

6. The foot-operated sanitizer dispenser is cost efficient.

3.6 DISADVANTAGES:

1. The use of pure sheet metal for manufacturing this product can sometimes lead to corrosion of certain parts after some time of usage.

2. In certain cases, on failure of spring mechanism, the pedal will remain in a neutral position, resulting in failure in the purpose of the machine.

3. This foot-operated sanitizer dispenser cannot accommodate a taller-sized sanitizer bottle than usual.

4. This machine can be only used for sanitizer bottles with a push-down mechanism.

5. In some instances, the sanitizer bottle could be stolen by detaching the clips from the outer movable pipe.

4. MODIFICATIONS:

Some major modifications can be done to the basic model, explained earlier in this paper, to improve the quality and performance of the product. These modifications include:

A) Use of stainless steel instead of pure sheet metal

Advantages:

1) Stainless steel, an alloy, does not easily corrode with water and also presence of chromium makes it highly corrosion resistant.

2) Even at high temperatures it is does not catch fire or heat making the product safer to use.

3) It provides ease of fabrication, welding and other machining process.

4) It provides a better surface finish and thus adds value to the product.

5) It has very has very less maintenance cost and further reduces cost, as it can be used with reduced thickness.

6) It is more durable and can be easily cleaned which makes is appropriate to be used in making this dispenser stand.

Disadvantages:

1) The biggest disadvantage of using stainless steel in our sanitizer dispenser is that it increases the cost of the product.

2) Although stainless steel products can be easily cleaned, they are prone to dust and dirt. So the product will have to be cleaned regularly for convenient use.

B) Two way foot operator

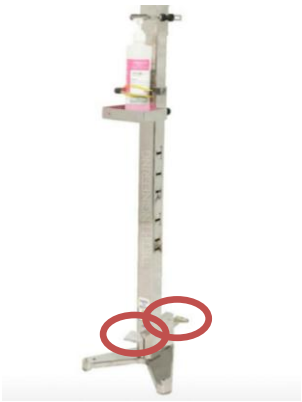

Fig (14)

In the basic model earlier in this paper we learned how the pedal forms the initial and most important part in the mechanism. So for more convenient use, as shown in this fig (14), the pedal can be provided on both the sides of the dispenser stand. Some advantages and disadvantages of the same are mentioned below:

Advantages:

1) It makes the product more convenient and flexible. We take an example to understand this better: This modification will prove helpful in many big companies by placing this stand at the entrance and the watchman sitting on the other side can use the pedal on his side to dispense the sanitizer for someone who is in his car. Many such cases can be considered where this mechanism will prove helpful.

2) From the above example it can also concluded that this two way foot mechanism will save time and effort.

Disadvantages:

1) Again this will increase the cost of the sanitizer dispenser since more material and components will be required to make such mechanism.

2) This will make the pedal mechanism more complicated and will take more time to manufacture as compared to single way foot operated mechanism.

3) Since the mechanism is complicated, if not properly manufactured there are chances of failure.

C) Safety lock

A safety lock or a bracket can be provided on the outer rod which will ensure the safety of our stand when no one is around to look after it. It can be used with a chain or a rope attached to some fixed rod or pillar. This lock will turn out to very helpful if the dispenser stand is to be placed in public places like temples, malls, parks etc.

D) Dual action (Pump and Spray):

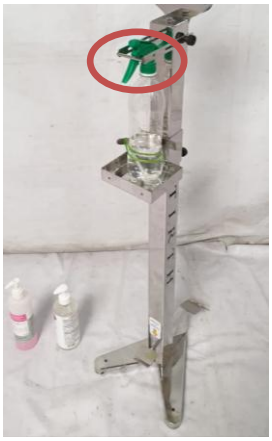

Fig (15)

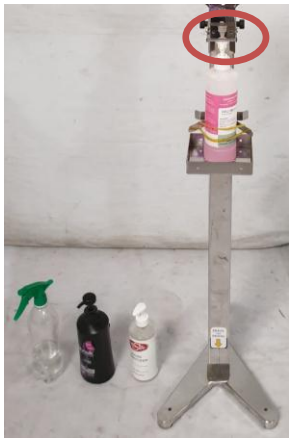

Fig (16)

This is the most important modification since it allows us to use the product as a sanitizer dispenser as well as a disinfectant to disinfect our belongings using a spray bottle instead of a normal bottle dispenser. This modification can be done using an adjustable clip as shown in the fig (15) and fig (16) instead of the top constraint part, used earlier in the basic model. The clip is provided with an adjustable knob to tighten or loosen the clip.

Advantages:

1) It adds a lot of value and convenience to the product since it allows the user to use dispenser bottle, for sanitizing hands, as well as a spray pump to disinfect belongings.

2) It has a very easy adjustment and hence is user friendly.

E) Height adjustment:

Fig (17)

In the basic model above we used clips and screws to fix the sanitizer bottle base to the outer pipe. Instead of that we can use fine height adjustment screws with knob for easily changing the position of the sanitizer bottle base according to height of the bottle or dispenser. All the user will have to do is turn the knob to loosen the screw and then adjust the base to desired height and then again tighten the screw to fix the position.

Advantages:

1) A sanitizer bottle of any height can be used by easily adjusting the base.

2) It makes the product more convenient to use and also makes it attractive.

F) Unbreakable case:

Fig (18)

An unbreakable case can be formed around the sanitizer bottle or sprayer so that no one can even attempt to touch it. Fig (18)

Advantage:

This case will prove to be helpful by preventing people from directly touching the bottle in cases where people do not know about this product and how it is operated using the pedal.

Disadvantages:

1) It will increase the cost of the product and even complicate it.

2) It will increase the time required to refill the bottle as compared to the basic model, shown earlier in this paper.

G) Instruction Chart and stickers:

Fig (19)

An instruction chart can be provided at the top of the product or be fixed to the outer pipe in the middle. Also stickers can be included in the product to make it more attractive and informative as well. Fig (19)

Advantages:

1) It can be used to spread awareness about the importance of cleanliness and sanitization.

2) It can help the user understand how to use the product since many people are unaware of such foot operated sanitizer dispenser.

3) It will make the product more attractive and didactic.

Disadvantages:

The position of this chart or stickers, when placed wrongly, may hinder the effectiveness of the mechanism.

5. COMPARISON:

Table -2:

Entities	Basic Model	Modified model
COST	Low	High
DURABILITY	High	High
STRENGTH	Comparatively Low	High
SURFACE FINISH	Low	High
WEIGHT	High	Low
FUNCTIONS	Less	More
MAINTANENCE	Low	Comparatively High
MECHANISM	Simple	Complicated

6. APPLICATIONS:

The applications of the foot-operated sanitizer dispensers are so vast that they can be placed upon any place with a heavy traffic of people. Shopping malls, supermarkets, gas stations, parks, etc. are some places where the machines could be placed. Some of the places which require immediate installation of these dispensers are:

Hospitals – These dispensers should be placed at regular intervals in the hospitals so as to prevent the spread of infections. Patients, Doctors, Nurses, Staff members, Visitors, etc. would be tremendously benefitted by this foot-operated sanitizer dispenser.

Restaurants - These machines can be placed at the entrance of all the restaurants, food chains, etc. People entering the restaurant will have their hands sanitized and clean for food consumption by the use of this machine. A dispenser can also be placed in the kitchen of all restaurants for the chefs and waiters.

Offices – The desks of the workers can be equipped with the foot-operated dispensers. Also the meeting rooms, conference rooms, can have these dispensers to avoid spreading of viruses.

Schools / Colleges – All Educational institutions must have these dispensers outside classrooms, in the cafeterias, near the playgrounds, etc. as a large number of students visiting the campus can easily contract viruses, infections from some infected students.

Religious places- Religious shrines such as temples, church, mosque, etc. consists of a large number of people visiting every day. So these sands can be placed at the entrance of these places. Also the modified stand can be used in this case which can even be used in disinfecting the belongings of the people visiting these places.

Industries- A huge number of people work in various industries around the world. Workers health is an important factor that affect their effectiveness and hence their role in the industry. This sanitizer dispenser would be effective in such case where sanitization is necessarily required.

The basic mechanism used in these dispensers can be also applied to various other products so as to simplify their operation and production. Foot-operated taps, foot-operated fans, etc. are some of the example products using the foot-activated lever mechanism.

7. CONCLUSION:

This foot-operated sanitizer dispenser is slowly but surely gaining popularity all over the world. This machine boosts up the process of sanitization. It is a frontline fighter against COVID-19. Also, due to the low manufacturing and production cost of this product, it is easily affordable by owners of huge industries as well as by small shopkeepers. This dispenser has seen a great market share these days. Many manufacturing factories have started producing these machines as they can be completely constructed from other industrial wastes, benefitting the factories.

These dispensers increase the awareness about hand hygiene among people and also contribute in creating a healthy environment for all. The use of these foot-operated sanitizer dispensers will surely help in reducing the number of COVID-19 positive patients.

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