Creosote and Ash Removal Device (C.A.R.D.)

Abstract

The Creosote and Ash Removal Device (C.A.R.D.) is used to remove creosote from chimney lining. C.A.R.D. scrubs and vacuums creosote into a disposal bag outside of the chimney. C.A.R.D. is a compact robot with embedded code designed to fit inside the average chimney. Using technology from both robot pool cleaners and vacuum cleaners, C.A.R.D. will work by climbing chimney walls using wheels whose tread mimic gecko feet. C.A.R.D will use three wire brushes to scrub dehydrated, calcified creosote from the chimney walls. Before using C.A.R.D, creosote acid treatment must be applied for the time specified, the creosote becomes brittle and hardens. Although this isn't done by C.A.R.D, once the treatment is applied, C.A.R.D. can systematically remove creosote and ash without putting people at risk.

ExploraVision: Creosote and Ash Removal Device (C.A.R.D.)

Present Technology

Spinning wire brushes are essential in creating mechanical robots that are built for cleaning. Currently, the creators of Roomba iRobot have used a specific multi-surface sweeping mechanism to help the robot clean debris off of exterior surfaces (How Does a Roomba Work?). There are two brushes; one is used to relax and soften litter on the floor and the other aids the debris' flow into the suction passageway (How Does a Roomba Work?).

The brushes are a key factor of the Roomba iRobot in making sure it works properly (How Does a Roomba Work?). Another present day technology that inspired C.A.R.D. is automatic robotic cleaners for pools. These robots can climb up steep, smooth walls and clean them at the same time (How Do Robotic Pool Cleaners Work?, 2019). The machine also includes electronic sensors that can scan the area to determine the most successful way to clean the pool (How Do Robotic Pool Cleaners Work?, 2019). Many pool cleaners contain the programmable technology for the user to be able to choose when they want the robot to clean the surfaces (How Do Robotic Pool Cleaners Work?, 2019). The engineering of the robots help make pool cleaning less of a hassle and more carefree (How Do Robotic Pool Cleaners Work?, 2019).

In chimneys, there is a substance called creosote. Creosote is a carbon chemical that forms by the distillation of coals and tars (Toxic Substance Portal - Creosote, 2015). This chemical is sticky and difficult to remove, which is why the current technology of creosote remover exists. This extractor puts the creosote into a more brittle state and forces the creosote to lose its adhesive properties, making it easier to slip off the surface (Cre-Away Creosote Remover).The remover also helps eliminate the odor of the creosote to make it less noticeable in

the chimneys (Cre-Away Creosote Remover). Although it is useful and helpful to use this spray, individuals must scrub off the creosote themselves which can be a taxing if not dangerous chore (Cre-Away Creosote Remover).

Finally, there are specific wheels, or tires that are used to climb up walls today. These tires are based on the physiology of the gecko and how they are able to stick on walls and move upwards. The geckos' toes are "covered with hundreds of microscopic bristles called setae, which generate a kind of electric force known as van der Waals force, strong enough to keep geckos stuck onto surfaces" (Choi, 2014). Scientists have put these bristles on tires to move small robotic mechanisms up walls, but the problem is that the weight of the wheels that is being carried is too limited (Choi, 2014). Since geckos are small creatures, the setae are able to carry it up steep walls (Choi, 2014). The weight that the tires are holding must be light enough for the wheels to be able to scale walls, which is much too small for the projected mass of C.A.R.D.

History

Some people fail to notice what an important resource rubber is. Natural rubber comes from " a milky liquid present in either the latex vessels or in the cells of rubber-producing plants" (What Is Natural Rubber and Why Are We Searching for New Sources?). While rubber had become an indispensable resource, scientists began to notice that the rubber would melt in the heat and crack in the winter causing it to lose its elasticity. This problem was solved in 1839 when Charles Goodyear invented the vulcanization process (What Is Natural Rubber and Why Are We Searching for New Sources?). Goodyear's invention would treat the rubber from melting when exposed to sulfur and heat, to harden it while keeping its elasticity (What Is Natural Rubber and Why Are We Searching for New Sources?). Little did Goodyear know that his

invention would inspire a man named John Boyd Dunlop to invent the world's first air-filled rubber tire (What Is Natural Rubber and Why Are We Searching for New Sources?). Dunlop's invention would make rubber to be one of the most essential raw materials during the Industrial Revolution (What Is Natural Rubber and Why Are We Searching for New Sources?).

Another material that was essential during that period was coal. A lot of homes in that era had chimneys to cook and keep their family's warm. Not only were chimneys useful but they could also become very dangerous. If the interior of chimneys weren't cleaned regularly it became "blocked with a build up of soot, causing chimney fires to occur" (Brief History of Chimney Sweeps). "The coal creates a sticky soot which often does not come loose easily, and chimney edges need scraping where soot builds up" (Brief History of Chimney Sweeps). In order for the chimneys to be cleaned the people would have to use sweeps to maintain them. "They had brushes with long handles to which the sweep screws extension poles as the brush goes up the chimney" (Brief History of Chimney Sweeps). This was an inefficient way of cleaning chimneys because the brushes would get stuck. The best way for everyone to get their chimneys cleaned during that time was to use children between the ages of 4 and 10. These boys were seen as the perfect fit for this job since they were usually small and could fit in these small tight spaces. However, this caused for the first industrial disease in history to be suffered by these young chimney sweeps. Chimney sweeps in their adolescence would frequently suffocate inside of the chimneys from breathing in the soot resulting in their death.

Future Technology

The Creosote and Ash Removal Device (C.A.R.D.) is a wall-climbing robot that will be capable of thoroughly cleaning chimney flues after a creosote acid treatment is applied. The

current design for C.A.R.D has five major components: the chassis, rotating wire brushes, vacuum, central processing unit (CPU), and wheels. The futuristic aspect of our design will be the wheels; modeled after the toe pads of gecko feet they will be able to scale the walls of chimneys. The wheels' traction comes from 3-D printed micro-strands on the tread that cannot be produced today.

C.A.R.D is designed to fit the cramped size limits of most chimneys, including the narrow openings of fire dampers. The robot's dimensions will be 15.24 by 11.43 by 27.94 cm. The 27.94 cm width of the device includes the 2.54 cm thick wheels attached to each side of C.A.R.D. The chassis will be made of 3.18 cm wide zinc-plated grade 5 punched angle steel and 3.5 cm zinc-plated, punched flat steel. The angled bar will make up the outer, rectangular frame of the chassis. The 90 degree angle and puncture holes will help keep the chassis secure. A 3.5 cm flat bar will branch between the two widths of the chassis, as added support to important components that will be stored in the device. The zinc-plated steel bars will be secured together by 0.952 cm 24 tpi (turns per inch) by 4.445 cm zinc-plated grade 5 fine thread hex bolts and nuts. While the chemicals found in both creosote and the acid treatment are corrosive, they require time to damage the metal. To counteract the eating away of the chassis C.A.R.D. would be cleaned after each use.

The rotating wire brush is a key part of C.A.R.D.'s design. This is the part of the design that breaks apart the already brittle creosote and ash. Three Forney 72732 wire cup brushes are attached to the front of the chassis, powered by a single high torque 12 volt DC motor. The motor spins at 200 revolutions per minute (RPM). The high torque motor will be connected to a

system of 1.27 cm diameter titanium gears that move the three brushes; minimizing weight and cost by using one motor.

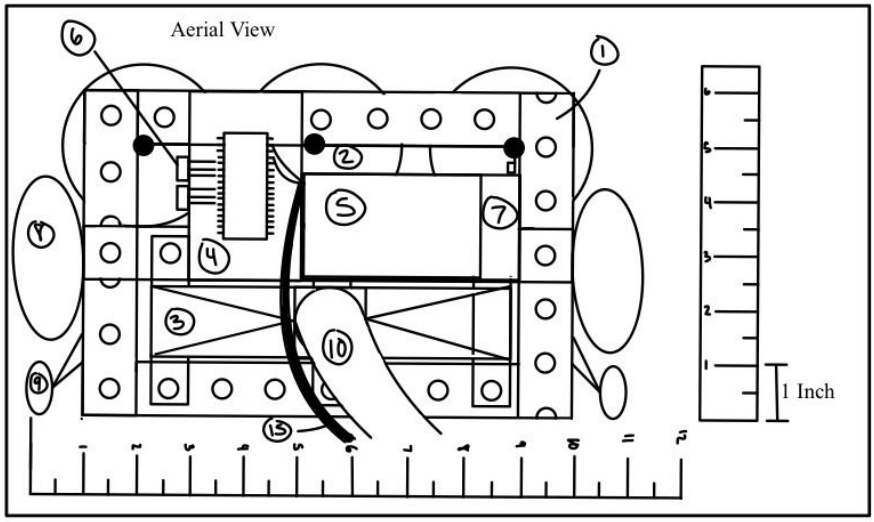
The ash and creosote scraped off the chimney flue is toxic and must be collected. C.A.R.D. uses an external vacuum to collect the debris through a tube. The fan in the vacuum creates a low pressure system that pulls the debris into a hopper. The hopper, a 17.78 by 5.08 by 2.54 cm rectangular pyramid, funnels into the 3.81 cm diameter, 7.62 meter long hose connected to the vacuum. This tube is attached to the bottom front of the vacuum pouch, transferring the creosote and ash into the bag. The vacuum pouch is 36.58 by 36.58 by 106.68 cm, supported by a 45.72 by 45.72 by 121.92 cm frame. The top of the vacuum bag will have an 20.3 cm diameter exhaust fan with a Purolator C38173 air filter. This fan and filter will remove air from the pouch, pulling more debris down. This vacuum and debris collection system sits outside the chimney, collecting creosote and soot as the robot goes up and down the chimney lining.

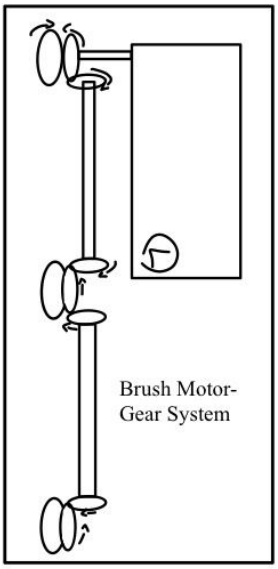
The device's central processing unit (CPU), power, and wiring was kept as simple as possible to minimize weight, cost, and size. The device's power source will be a standard 120 volt outlet, this connects to the robot's CPU and it's motor controllers(MC). MC's will then route power to different parts of the device.-The circuit has a ESP8266 ESP-12E WiFi microcontroller chip that communicates with the-motor controllers. MC's distribute power and stop the circuits and voltage regulators from frying by controlling surges. The voltage regulator then gives the motor the power to move as directed by the CPU.

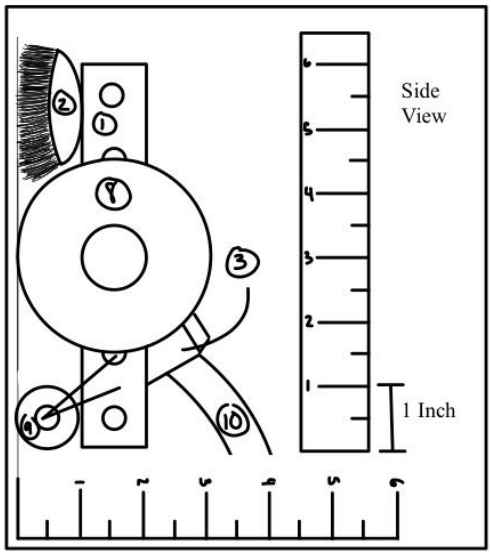
C.A.R.D.'s futuristic aspect is the gecko inspired wheels attached to each side of the device. The wheel will be made of a butadiene, silicon, and thermoplastic polyurethane mixture. Butadiene is the base of the rubber blend because of its durable qualities. Silicon will be added

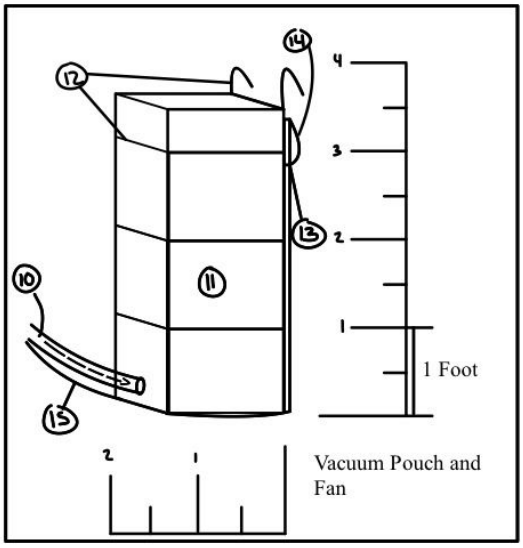
for malleability (Dunham, Bailey, & Mixer, 1957). Thermoplastic polyurethane-will be helpful in production. The design of the tread on the tires is modeled after gecko feet, replicating the lamellae, setae, and spatulae (Dickerson, 2014). Current 3D printers cannot print small enough to produce the wheels (What is the smallest feature you can print?). There will be one small plastic wheel attached on the back of each side of C.A.R.D. for stability.

Diagram

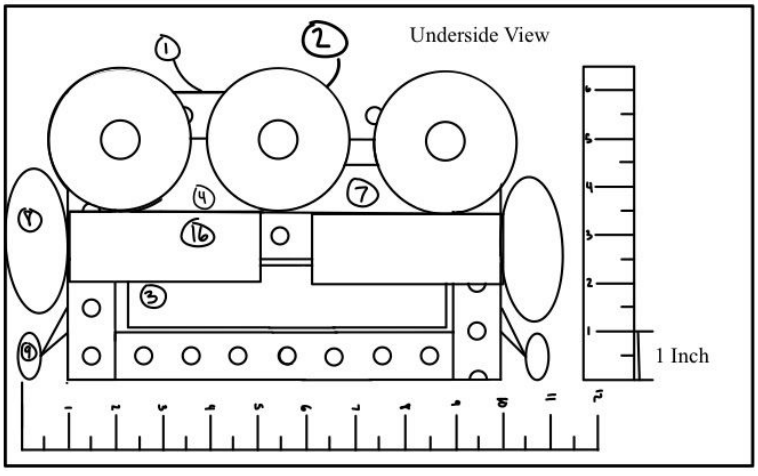








Key:
1. Chassis
2. Rotating Wire Brush
3. Debris Hopper
4. CPU
5. Motor Controllers
6. Voltage Regulator
7. Brush Motor
8. Gecko-Tread Wheels
9. Stability Wheels
10. Debris Hose
11. Vacuum Pouch
12. Vacuum Frame
13. Air Filter
14. Exhaust Fan
15. Power Cord
16. Wheel Motors



Breakthroughs

The futuristic aspect of the Creosote and Ash Removal Device (C.A.R.D.) design will be the function and materials used for the wheels. The traction of the rubber will be modeled after the toe pads of gecko feet. The wheels will be made with micro-strands that cannot be produced today. The gecko inspired high traction wheels would be capable of climbing walls at a 90 degree angle. The one of the main breakthroughs necessary for this invention to become a reality are the types of rubber to ensure the machine is ready to climb up and down steep walls.

All of the rubber materials in the tire are modeled after the toe pads of gecko feet, that have features called the lamellae, setae, and spatulae help the geckos stick to heavily inclined surfaces (Dickerson, 2014). These features will be replicated in the tread. Currently, scientists have only been able to recreate the setae and spatulae together to do one function, but not individually and separate. The tires of the device would fully replicate the gecko toe pads using smaller more precise instruments for tire production. This would include the micro-strands that are essential to enable C.A.R.D. to easily stick to the walls. These micro-strands are found on the tiny pads on the feet of geckos and are responsible for the geckos' ability to run up walls quickly and efficiently.

Even though 3D printing is available to help produce parts of the wheels, the micro-strands are so minute that 3D printers do not yet have the capacity to print something so small. This is the most critical breakthrough for the invention for C.A.R.D. to work correctly. The micro-strands must be printed using the rubber-like material the tires of the device will be made out of. There could be other ways to produce this, but 3D printing will most likely be the most efficient way to accomplish what C.A.R.D. needs. 3D printing can only go as small as 0.6

millimeters in width without breaking or not fully filling in, and the micro-fibers must be 0.005 mm in width (26, 2018). This is ⅛ width of a single human hair, which is quite small to produce using rubber materials. With the availability of manufacturing this tiny, but critical component of C.A.R.D., then this invention can become a reality. A research project that could test these new wheels would be to create these specific rubber tires and see if they have enough traction to go up walls at a 90 degree angle. The independent variable would be the design in the making of traction of the tires and the dependent is how high the wheels can climb. The hypothesis will test which type of tire design will be able to climb 25 feet of creosote covered walls. With numerous tire designs being tested, the rubber used in the wheels and micro-strands serving as the tread pattern will serve as constants with the type of wall being climbed. The independent variables of the experiment will be the wheel design, the dependent will be how high the wheels carry the robot.

Design Process

One of the original components of C.A.R.D. was a spray used to apply the creosote acid treatment that calcifies the creosote. This acid treatment brittles the buildup of toxic materials allowing chimney sweeps, or in this case C.A.R.D, by dissolving the soot embedded in the creosote, making it easier to scrub off (chimneysaver.com). Creosote acid treatments are an important step to effectively cleaning a chimney but can require around forty eight hours, to a week depending on the product, to dehydrate and reduce the elasticity of the creosote (Mayor & Dechow). Because of the time required between the application of the treatment and when the creosote is ready to be removed it was deemed unserviceable to include a spray to distribute the

acid treatment. The creosote acid treatment distribution system was removed from C.A.R.D.'s design, reducing the weight and complexity of the design.

In addition to the removal of the acid treatment spray feature, the vacuum was also taken off the chassis. Because of the average calculated chimney lining's surface area and creosote thickness it was calculated that C.A.R.D. would need to be capable of safely removing and storing 0.14 cubic meters of creosote and other debris. To ensure C.A.R.D. was a practical tool for all homes, the robot design was made to fit the smallest chimney openings possible. At first, C.A.R.D. was designed with the vacuum and vacuum bag attached to the back of the device but any realistic vacuum collection system was too large to feasibly meet the design's needs and the space restrictions of the average chimney. It was decided to attach a tube that connects the robot to a vacuum pump and debris collection bag found outside the chimney. This vacuum is seperate from the main robot design. As seen in the diagram, a hopper collects debris scrubbed off by the rotating wire brushes. This hopper funnels debris into a rubber tube that connects to the vacuum collection system.

An important aspect of the design process besides discarding nonessential components was efficiency. Motors are powerful, albeit heavy and costly, sources of torque often used in robotics. The initial design of C.A.R.D. had a motor for each individual wire brush. To lower the weight and cost of C.A.R.D. a single motor will be used to rotate all three brushes. A transmission, or gear train, was designed to distribute the work of one motor to three wire brushes. There was some reason for concern with the transmission design because the first gear would receive too much strain. To ensure that the primary gear is able to handle the stress all

gears would be titanium. While using one motor per rotating wire brush was not necessarily an issue it was deemed prudent to consolidate the work of rotating all three brushes to one motor.

Consequences

Although the development of Creosote and Ash Removal Device (C.A.R.D.) will have positive effects, it will have some negative outcomes. Some possible negative outcomes include: the expenses of purchasing this device, unethical business practices, and removing jobs from the market. The expense of purchasing this device could be high because of the raw materials and specialized assembly. There could also be a high human cost because of unethical mining. The development of this device would also put chimney cleaners out of their jobs because C.A.R.D is a robotic device used to clean and remove ash and soot from the walls of chimneys. C.A.R.D would, potentially, become the go-to choice for chimney maintenance.

Despite some of these negative possibilities, C.A.R.D is also projected to have a positive impact. It is a faster, easier, and safer way to clean chimneys. “A standard chimney cleaning will take between 45 minutes and an hour” (Clean Sweep, 2020). With C.A.R.D’s high traction, rubber tread tires that enable the robot to climb the steep walls of the chimney and its design to fit the cramped size limits of most chimneys, it will be able to clean the chimneys faster than a trained worker. C.A.R.D would also be an easier way to clean chimneys since chimney workers usually have to do all their work manually. With the use of C.A.R.D you are avoiding health hazards such as eye damage, which is caused by Creosote exposure. Creosote also poses as a hazard to one’s respiratory system and epidermis, inhaling soot and smoke is toxic, physical contact with creosote can result in chemical burns (Sweet, 2017).

Although the development of Creosote and Ash Removal Device could cause chimney cleaners to lose their job, many people with chimneys in their homes will benefit from this device, young or old.

Works Cited

24-Hour Chimney and Fireplace Inspections with Clean Sweep. (2017, July 04). Retrieved November 12, 2020, from https://cleansweepmaryland.com/24-hour-chimney-and-fireplace-inspections-with-clean-sweep/

26, F. (2018). What is the smallest feature that you can print? Retrieved November 16, 2020, from https://support.xometry.com/hc/en-us/articles/217723698-What-is-the-smallest-feature-that-you-can-print-

Baxley, R. (2015, May 16). [Image of before and after a rectangular chimney has been cleaned; thick, shiny, black creosote on left]. Retrieved January 26, 2021, from https://www.environmentalchimneyservice.com/new-method-for-cleaning-3rd-degree-glaze-with-saversystems-poultice/

Biography.com, E. (2019, November 6). [Black and white image of Charles Goodyear]. Retrieved January 6, 2021, from https://www.biography.com/inventor/charles-goodyear

Boley, M. (2019, December 30). [Colorful diagram showing inner parts of chimney after creosote damage]. Retrieved January 6, 2021, from https://www.familyhandyman.com/article/when-to-clean-a-chimney-flue/

Brief History of Chimney Sweeps. (n.d.). Retrieved October 14, 2020, from https://www.sweepsmart.co.uk/post/brief-history-of-chimney-sweeps

ChimneySaver. (2020). Cre-Away Pro Creosote Remover. Retrieved November 20, 2020, from https://chimneysaver.com/product/cre-away-pro-creosote-remover/

Choi, C. (2014, November 21). Gecko Tech: Sticky Invention Lets People Scale Walls. Retrieved October 14, 2020, from https://www.livescience.com/48845-gecko-inspired-tech-climbing-walls.html

Cleaning Chimney Before and After [Digital image]. (2014, June 22). Retrieved January 6, 2021, from https://www.portablefireplace.com/blog/clean-chimney-use/

Cre-Away Creosote Remover. (n.d.). Retrieved October 14, 2020, from https://chimneysaver.com/product/cre-away-creosote-remover/

Dunham, M., Bailey, D., & Mixer, R. (1957, September 1). New Curing System for Silicone Rubber. Retrieved October 15, 2020, from https://pubs.acs.org/doi/abs/10.1021/ie50573a029

FindAGrave, J. (2019, December 19). [Image of Philip Straus, clean shaven, in a suit and tie]. Retrieved January 6, 2021, from http://dunlopjohn.blogspot.com/2010/10/john-boyd-dunlop.html

Gough, Z. (2015, September 2). [Bottom view of light blue gecko with orang/yellow spots, focused on toe pads]. Retrieved January 26, 2021, from http://www.bbc.com/earth/story/20150902-new-secret-of-gecko-stickiness-revealed

How Do Robotic Pool Cleaners Work? (2019, November 13). Retrieved October 14, 2020, from https://bestvacuumresource.com/how-do-robotic-pool-cleaners-work/

How Does a Roomba Work? (Animation). (n.d.). Retrieved October 14, 2020, from https://www.thezebra.com/resources/home/how-roomba-works/

How Long Does a Thorough Chimney Inspection and Cleaning Take? (2020, May 26). Retrieved November 20, 2020, from https://cleansweepmaryland.com/how-long-does-a-thorough-chimney-inspection-and-cleaning-take/

http://dunlopjohn.blogspot.com/2010/10/john-boyd-dunlop.html

John Boyd Dunlop [Image of John Dunlop in a black and white photo, smiling at the camera.]. (2010, October 18). Retrieved January 6, 2021, from http://dunlopjohn.blogspot.com/2010/10/john-boyd-dunlop.html

Mayor, W. R., & Dechow, C. F. (1988). *U.S. Patent No. US4888030A*. Washington, DC: U.S. Patent and Trademark Office.

Nicholas St. FleurAug. 8, 2., Jeffrey MervisOct. 13, 2., Ignacio AmigoOct. 13, 2., Chelsea Harvey, E., Cathleen O'GradyOct. 12, 2., Daniel CleryOct. 9, 2., . . . Rebekah TuchschererSep. 4, 2. (2017, December 10). What Gets Geckos Unglued. Retrieved October 14, 2020, from https://www.sciencemag.org/news/2012/08/what-gets-geckos-unglued

Quick, D. (2010, August 5). [Image of Mark Fehlburg looking up and to his right at his wall climbing robot]. Retrieved January 6, 2021, from https://newatlas.com/rocr-wall-climbing-robot/15948/

Ridgeway, A. (2018, August 28). Chimney Health Hazards You Should Know About - Cherry Hill NJ. Retrieved November 20, 2020, from https://www.masonschimneyservice.com/chimney-health-hazards-know/

Toxic Substance Portal - Creosote. (2015, January). Retrieved October 15, 2020, from https://www.atsdr.cdc.gov/phs/phs.asp?id=64&tid=18

What Is Natural Rubber and Why Are We Searching for New Sources? (n.d.). Retrieved October 14, 2020, from https://kids.frontiersin.org/article/10.3389/frym.2019.00100

Y., S., Alyssa Y. Stark Alyssa Y. Stark Integrated Bioscience Program, Stark, A., Alyssa Y. Stark Integrated Bioscience Program, Subarajan, S., Shairani Subarajan Integrated Bioscience Program, . . . One contribution of 12 to a theme issue ‘Bioinspired hierarchically structured surfaces for green science’. (2016, August 06). Superhydrophobicity of the gecko toe pad: Biological optimization versus laboratory maximization. Retrieved October 14, 2020, from https://royalsocietypublishing.org/doi/10.1098/rsta.2016.0184

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Please photocopy this sheet

Home | Design | Applications | History | More Information

The Creosote and Ash Removal Device

(*Cleaning Chimney Before and After* 2014)

Did you know that creosote, a by product of fire found in smoke, is toxic? Exposure to the dark substance can result in chemical burns and harsh reactions. Creosote is not only toxic to the touch but is also a cause for chimney fires. Cleaning chimneys, especially ones that haven't been cared for in years is difficult and must be done carefully. The Creosote and Ash Removal Device (C.A.R.D.) is a small, robotic device used to clean and remove the harsh creosote. Using its high traction wheels, modeled after the toe pads of gecko feet, C.A.R.D. climbs up the steep, grimy chimney lining to scrub away the built up ash and creosote for you!

CARD

Click Here to fill out a contact form to get into contact with an operator near you!

Not sure if C.A.R.D. is right for you? Click Here to look at FAQ's!

In the space below, please describe any special effects that might be applied to your web page.

Each tab, when tapped, will take the user to the corresponding web-page according to the tile selected.

" Click Here" links to a contact form where users can fill out a form and be put into contact with a C.A.R.D. employee.

"Here" on the mid right of the screen links to a frequently asked questions page.

Sample Web Page #_1__ of 5 (must include 5 forms)

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Please photocopy this sheet

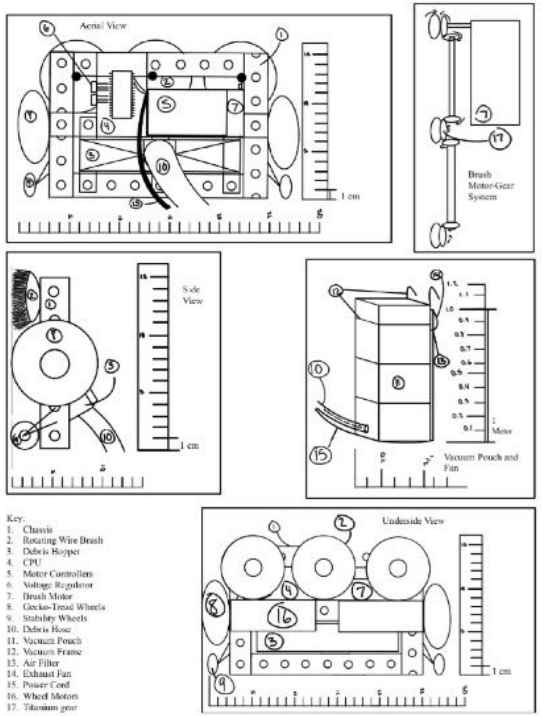
Home | Design | Applications | History | More Information

C.A.R.D. Diagram

How Does It Work?

The Creosote and Ash Removal Device (C.A.R.D.) is a wall-climbing robot that will be capable of thoroughly cleaning chimney flues after a creosote acid treatment is applied. Wheels modeled after the toe pads of gecko feet allow the device to climb up walls while rotating wire brushes scrub away the creosote. All the debris and scrubbed off ash is vacuumed through a hose and into a pouch waiting outside the chimney. The design for C.A.R.D has five major components:

- Chassis
- Rotating Wire Brushes
- Vacuum
- Central Processing Unit (CPU)
- Wheels



C.A.R.D.

(Baxley, 2015)

Watch C.A.R.D. in action!

(Gough, 2015)

Watch to learn about the science behind C.A.R.D.

Each tab, when tapped, will take the user to the corresponding web-page according to the tile selected.

In the space below, please describe any special effects that might be applied to your web page.

If the play button on the image of a gecko is selected the video enlarges and centers on the screen before playing a video describing the science behind C.A.R.D.

If play icon on image of before and after a chimney is cleaned is selected the video enlarges and centers on the screen before playing a video of C.A.R.D. Cleaning a chimney.

When selected, the diagram image will enlarge and have small a all description the five major components of C.A.R.D.

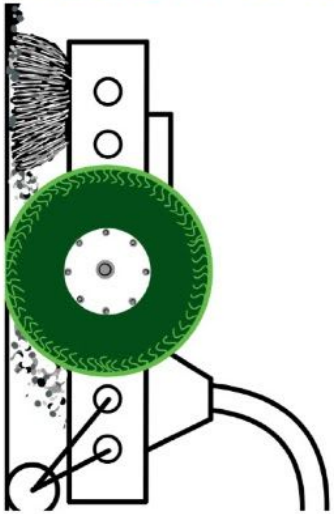
Sample Web Page # 2 of 5 (must include 5 forms)

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Please photocopy this sheet

Home | Design | Applications | History | More Information

C.A.R.D. - An Easy and Safe Way to Clean Chimneys



The Creosote and Ash Removal Device is an effective and safe way to remotely clean your chimney. When wood burns, something called creosote is the black or dark brown substance you see in the smoke. This substance is toxic and flammable, when there is too much buildup you not only risk the integrity of your chimney and health but puts your home at risk. Chimney fires have been known to burn down houses if there is too much of a build up. Designed to be compact, C.A.R.D. is capable of cleaning most chimneys. Three wire brushes scrub dehydrated creosote, the debris is then sucked into a vacuum pouch and stored. The creosote must be properly disposed of.

In the space below, please describe any special effects that might be applied to your web page.

Each tab, when tapped, will take the user to the corresponding web-page according to the tile selected.

Icons under article title link to their respective social media websites with the article is linked to share.

When selected, the article image enlarges and centers on the screen.

Sample Web Page # 3 of 5 (must include 5 forms)

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Please photocopy this sheet

Home | Design | Applications | History | More Information

1839- Charles Goodyear invents the vulcanization process which treats rubber to harden it while keeping its elasticity.

(Biography.com, 2019)

1867- John Boyd Dunlop invents the first practical air-filled rubber tire, making rubber one of the most essential raw materials.

(*John Boyd Dunlop* 2010)

1911- Philip Strauss invents a combination of tire materials and an air-filled inner tube that was meant to be used for automobiles.

(FindAGrave, 2019)

2010- Mark Fehlberg engineers the first robot ever able to climb straight up walls with ease.

(Quick, 2010)

In the space below, please describe any special effects that might be applied to your web page.

Each tab, when tapped, will take the user to the corresponding web-page according to the tile selected.

When selected, all images on this page enlarge and displays a small biography on the person selected.

Sample Web Page #__4__ of 5 (must include 5 forms)

TOSHIBA/NSTA EXPLORAVISION SAMPLE WEB PAGE FORM

Please photocopy this sheet

Home | Design | Applications | History | More Information

C.A.R.D. The Modern Chimney Cleaner

(Boley, 2019)

Transcript:

Finally, a safe, efficient, and simple way to clean years worth of creosote, dirt, and grime off of house chimneys!

C.A.R.D., is a unique type of machinery that can move up steep walls and thoroughly scrub the average chimney. No more hassle of finding a qualified chimney cleaner when you can have C.A.R.D. and a trained professional come and remove the toxic creosote for you!

For More Information Go To:

https://www.doctorflue.com/blog/what-is-creosote/

https://www.chimneyspecialistsinc.com/blog/flue-chimney-fire-risk/

https://www.mychimney.com/blog/about/5-most-common-chimney-problems/

In the space below, please describe any special effects that might be applied to your web page.

Each tab, when tapped, will take the user to the corresponding web-page according to the tile selected.

Clicking on play button above plays and enlarges a video about C.A.R.D.'s performance and the cleaning process.

Websites listed on the mid-right of the screen link to articles about chimney cleaning and the dangers of creosote and chimney fires.

Sample Web Page # 5 of 5 (must include 5 forms)