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(54) **ANIMAL GUARD**

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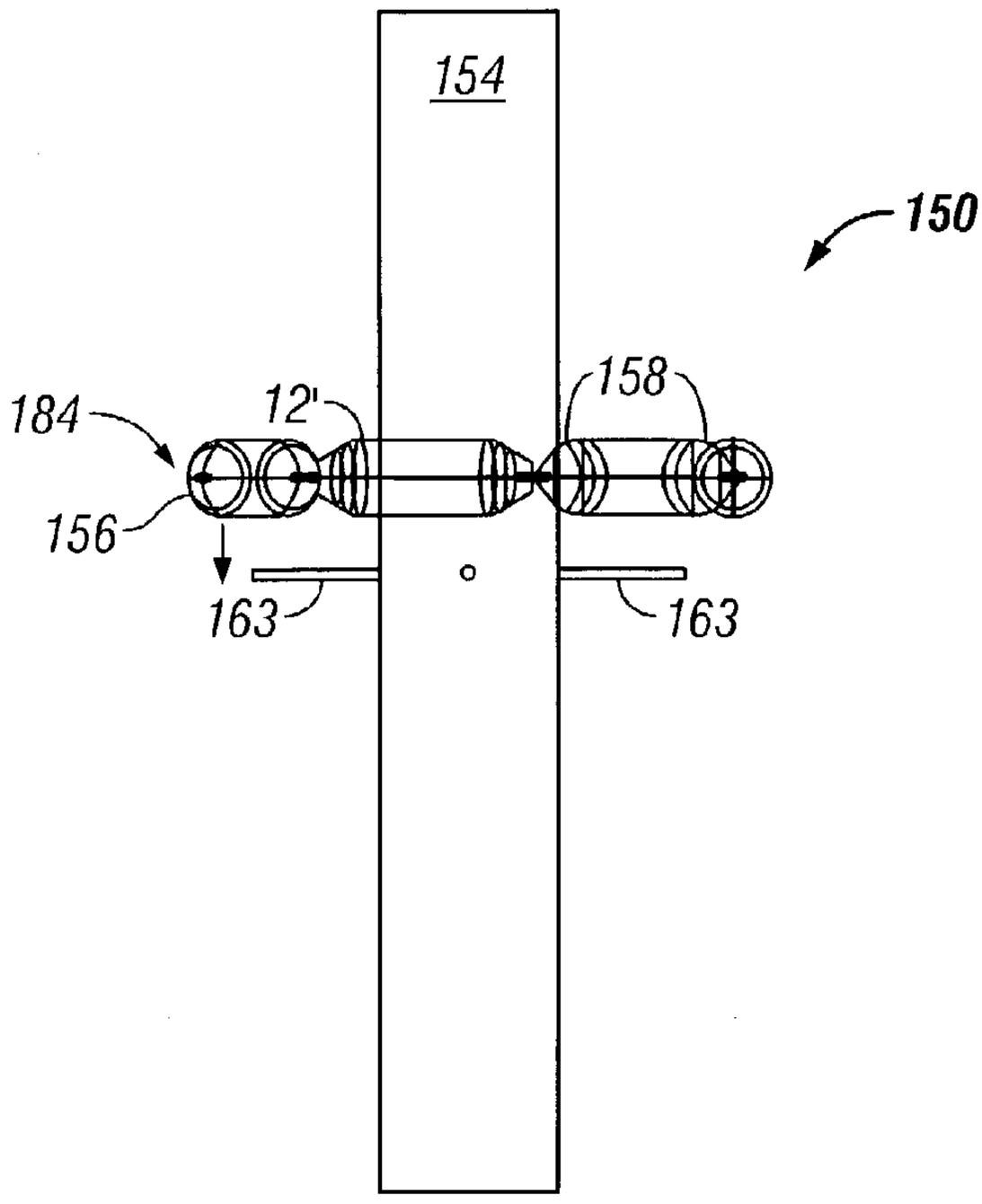
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(52) **U.S. Cl.** **52/101**

(57) **ABSTRACT**

An animal guard with a multitude of rotatable elements that can be securely mounted on a generally vertical or horizontal structure is disclosed. The rotatable elements may be of varying shapes and are designed to provide an unsteady footing for animals attempting to cross the object to continue travel along the structure. In accordance with one embodiment, the animal guard is configured to surround a vertically-extending structure. A series of hollow rotatable elements, or "spinners", are provided with a hole formed at opposing longitudinal ends. The spinners are bifurcated into two generally equal halves that attach together. A guard plate is mounted to surround the structure and has a series of cross arm brackets which extend through the end holes of the spinners to serve as end axles for rotation and to position the spinners around the circumference of the structure. A support means secures the location of the guard plate and spinners and couples the guard plate to the structure. Another embodiment of the animal guard inhibits animal passage along generally horizontal structures, such as cables, lines and wires. This embodiment could also be installed on vertical or diagonal structures, such as guy wires and the like. A series of hollow rotatable spinners are provided with a hole formed at opposing longitudinal ends. The spinners are bifurcated into two generally equal halves that attach together to secure the spinners around a horizontal structure. End shields are configured with a hole extending laterally therethrough to mount the end shields onto an end section of the spinners; one end shield is positioned at each of the opposite ends of a series of spinners. A gripping means is positioned adjacent to the end shields at the opposite end of the series of spinners to grip the horizontal structure and hold the end shields and spinners at fixed positions horizontally along the line.



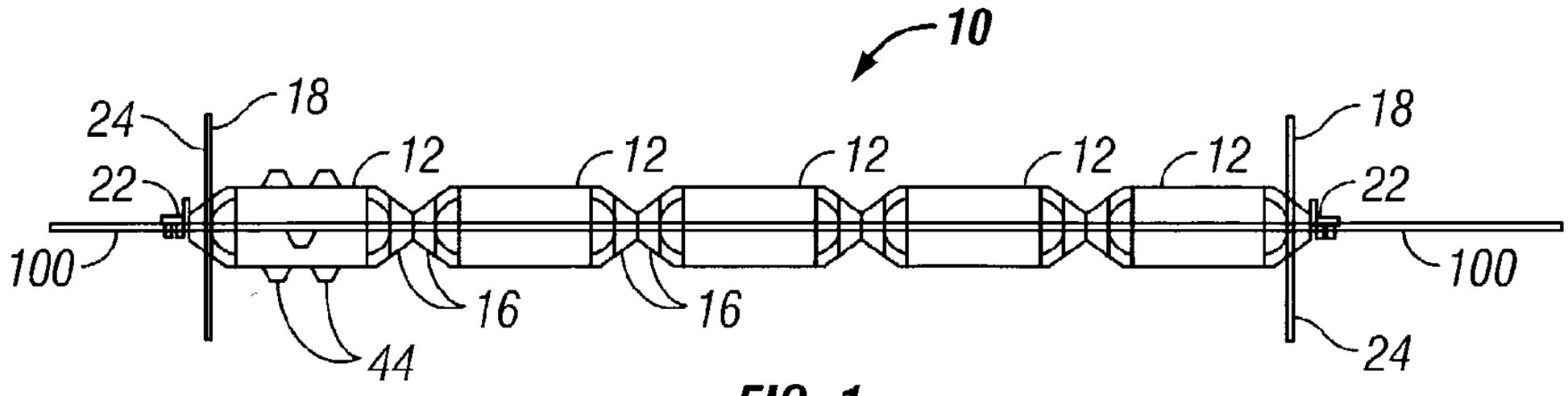


FIG. 1

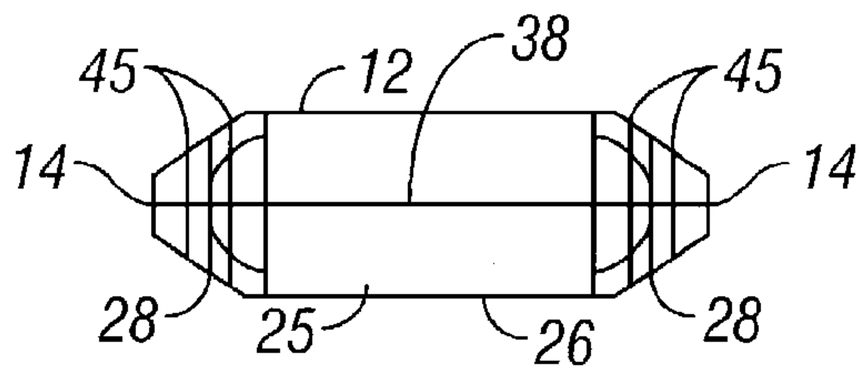


FIG. 2

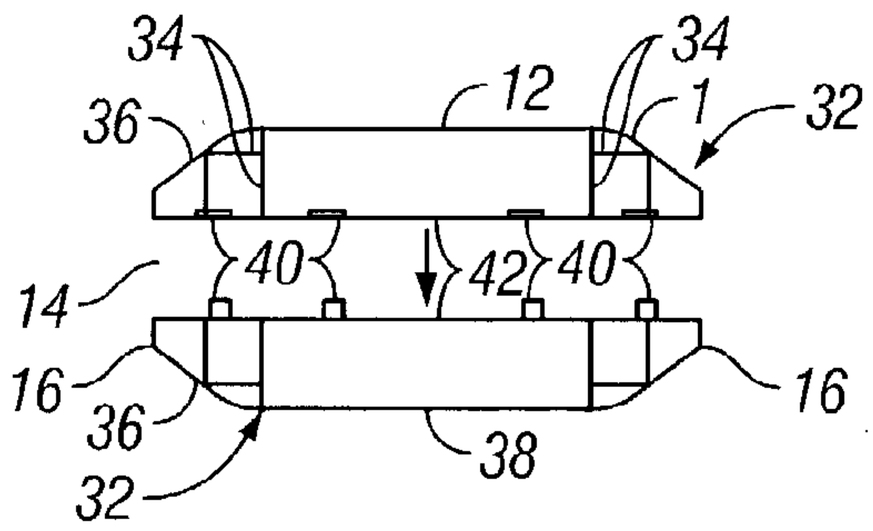


FIG. 3

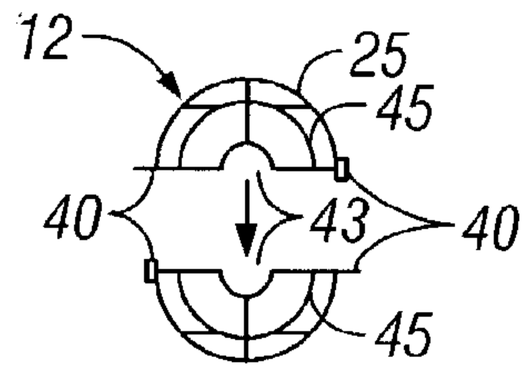


FIG. 4

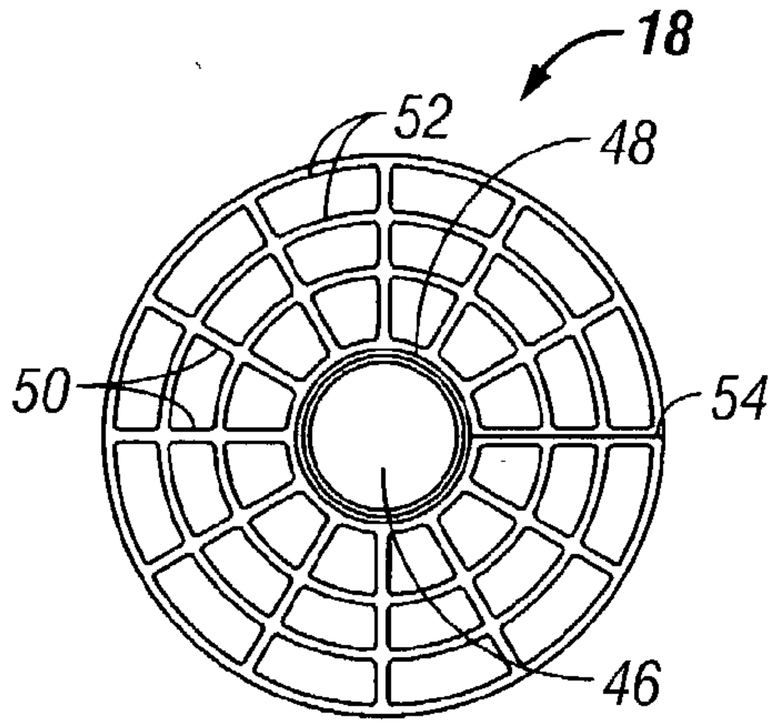


FIG. 5

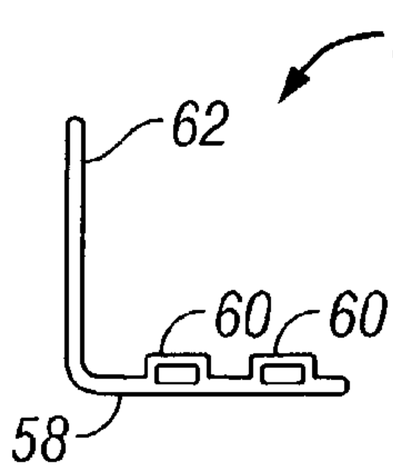


FIG. 6

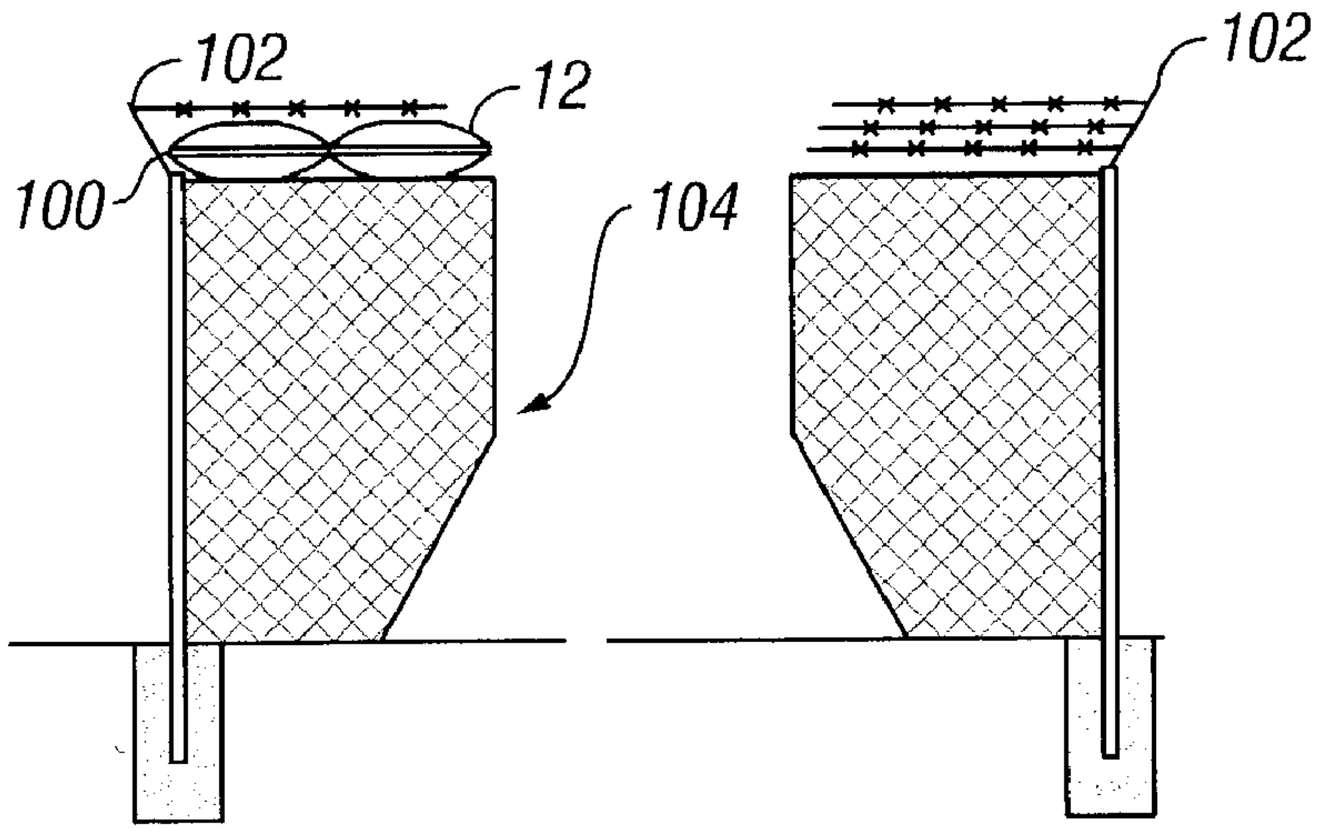


FIG. 7

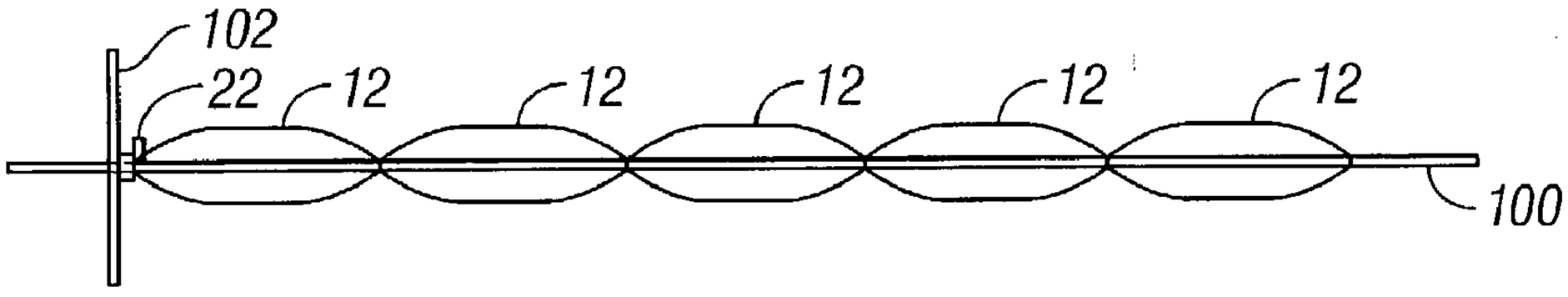


FIG. 8

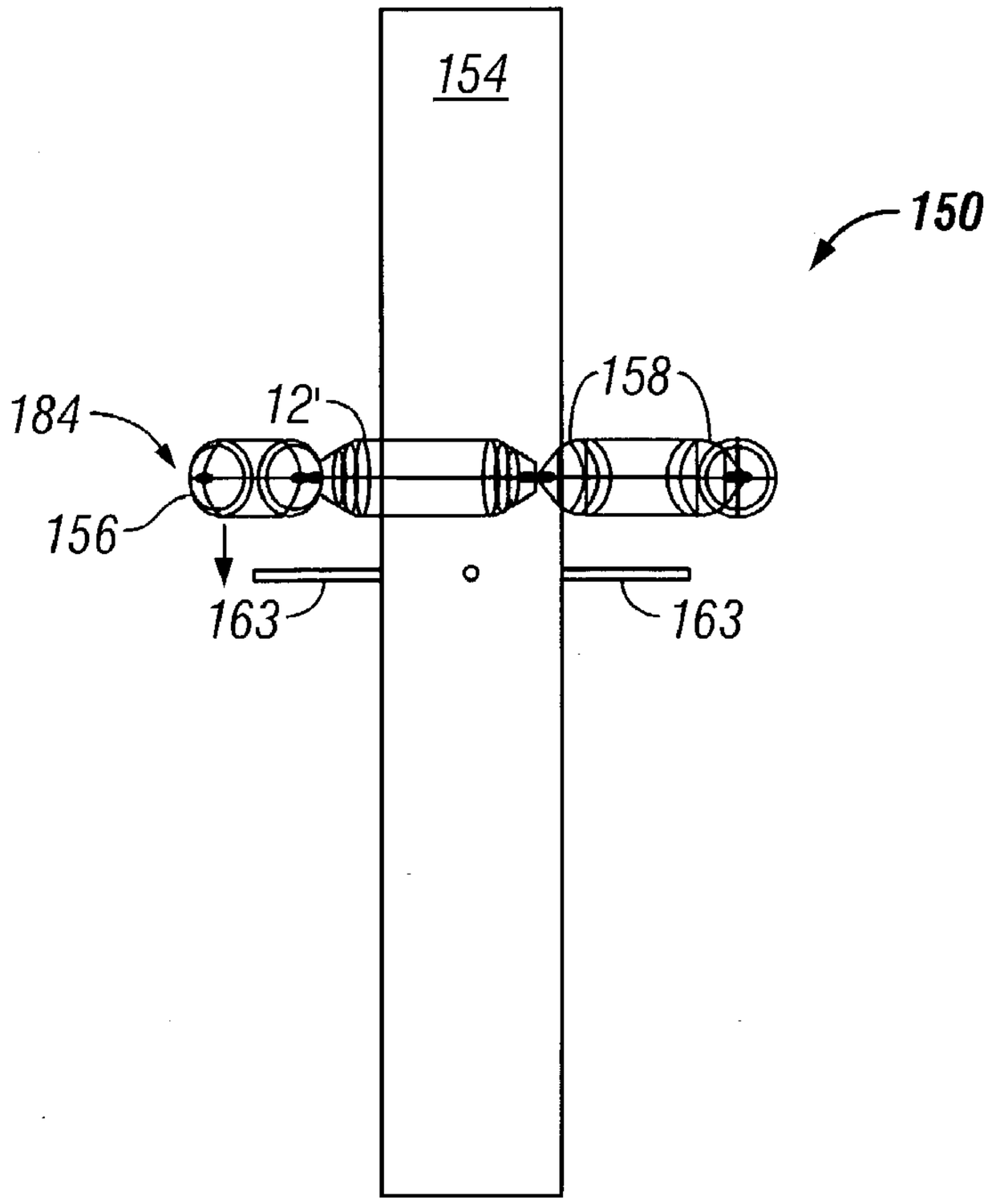

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FIG. 9

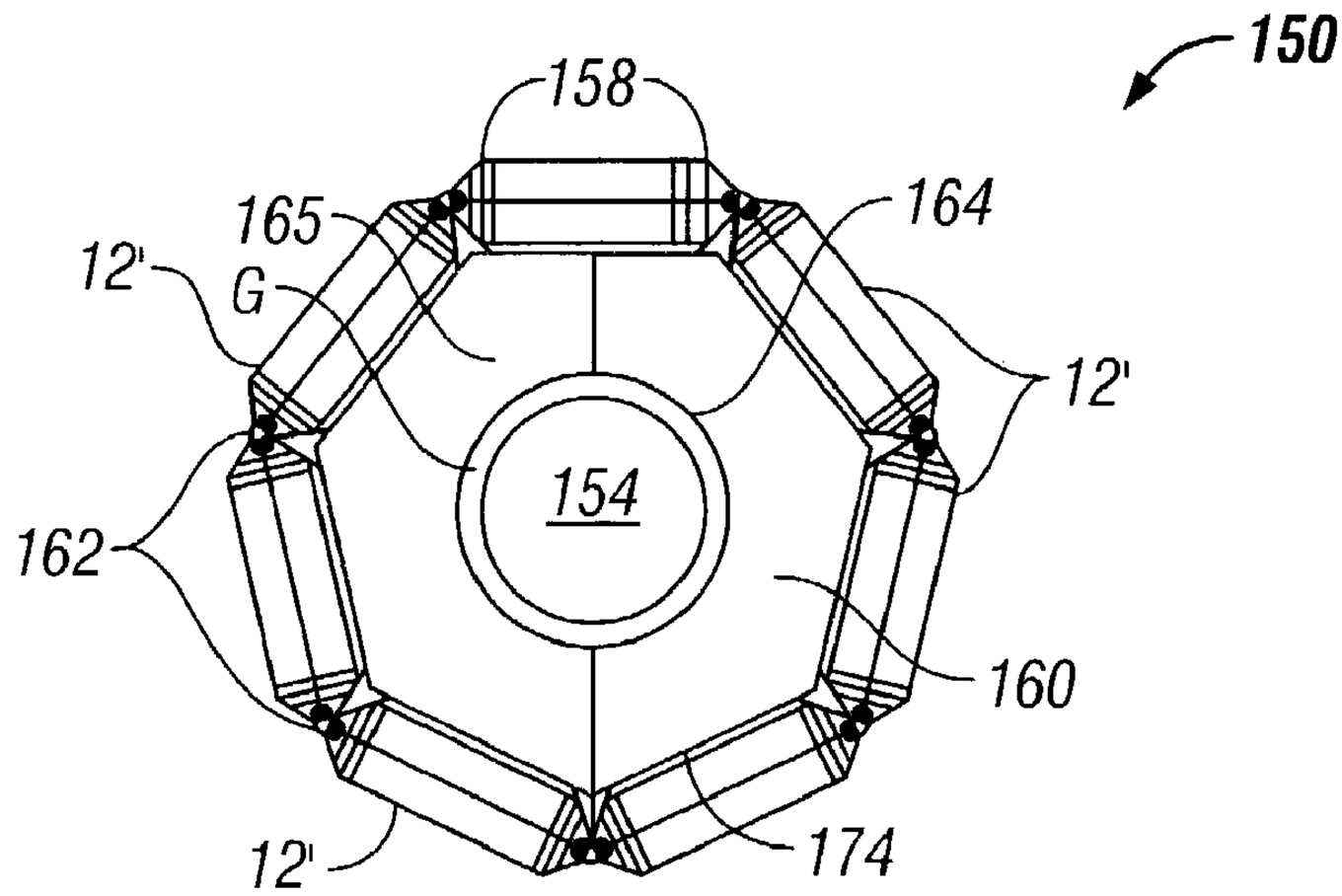

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FIG. 10

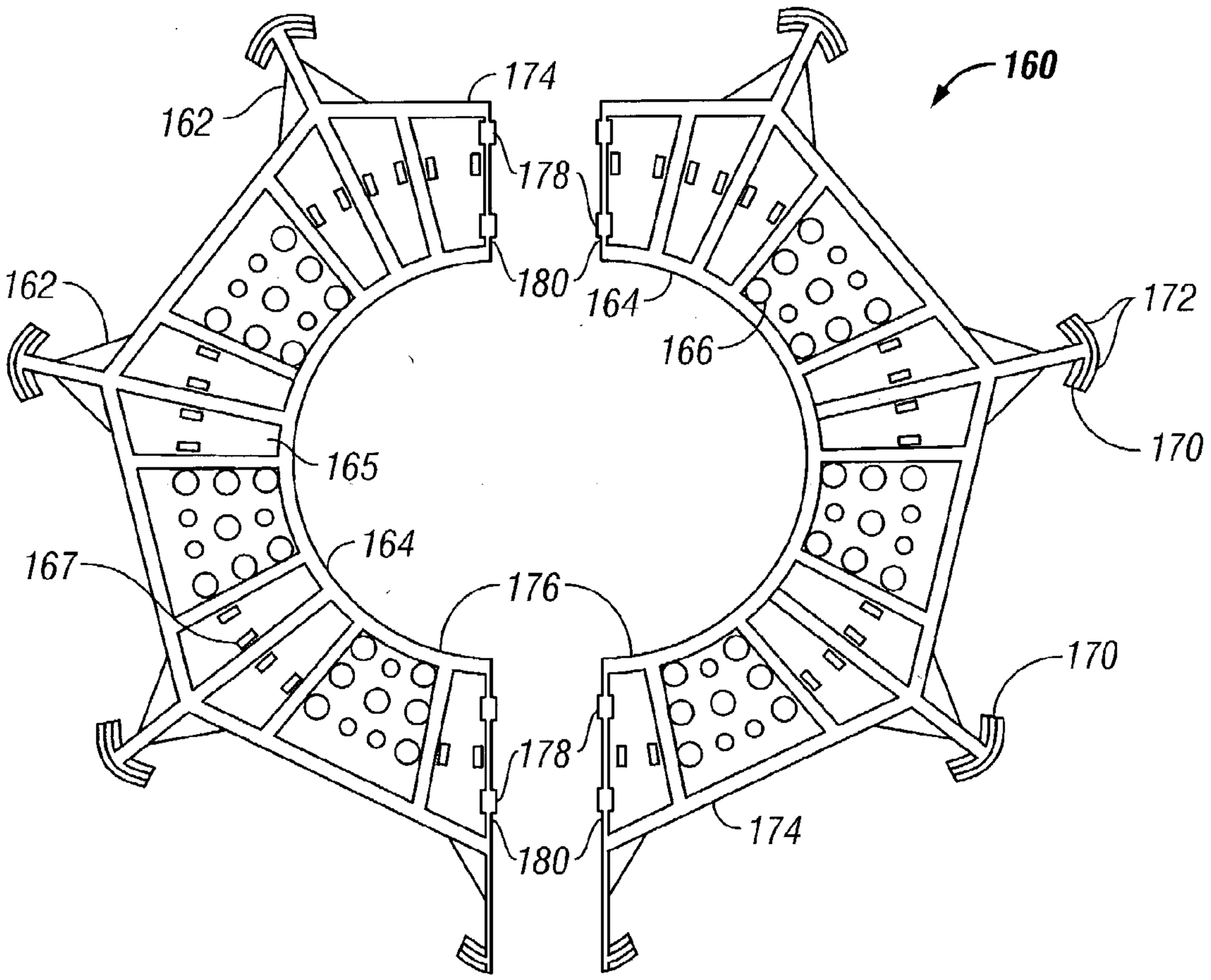

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FIG. 11

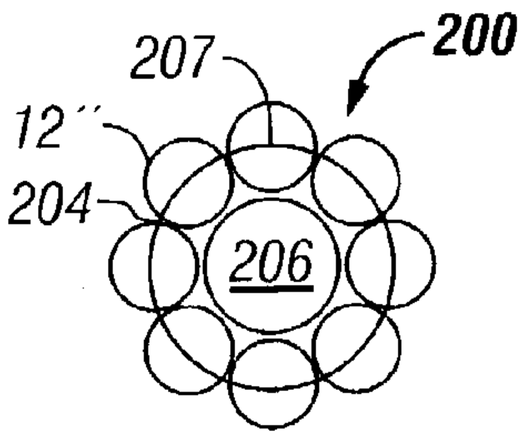


FIG. 12A

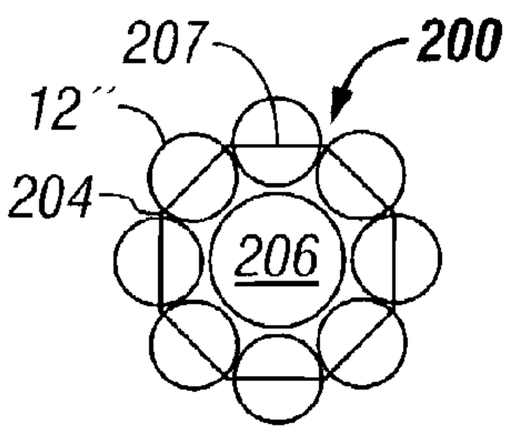


FIG. 12B

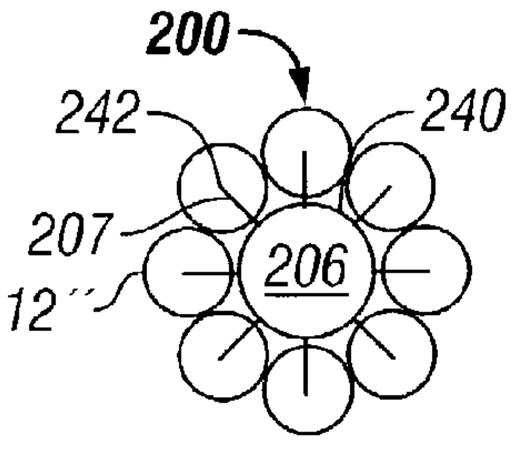


FIG. 12C

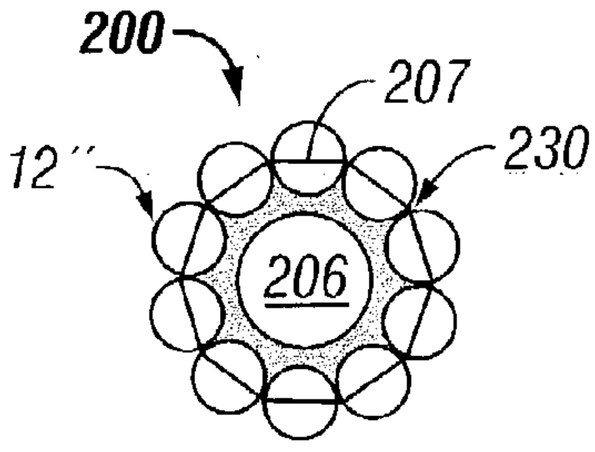


FIG. 12D

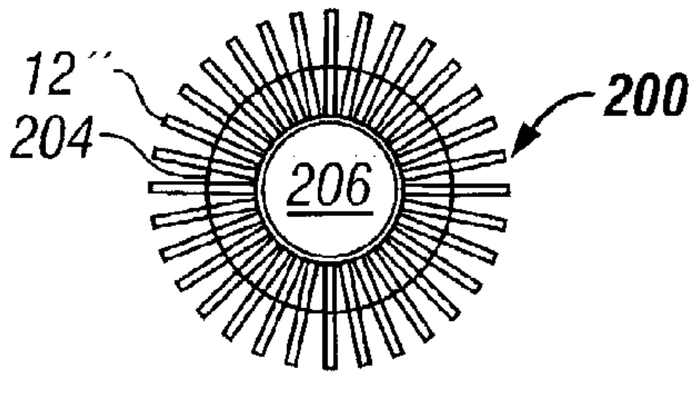


FIG. 12E

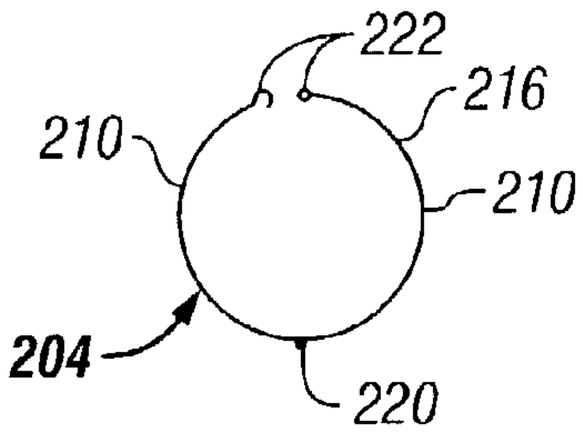


FIG. 13A

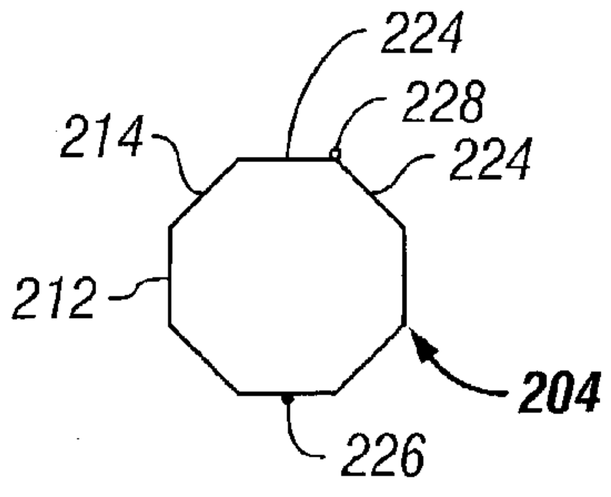


FIG. 13B

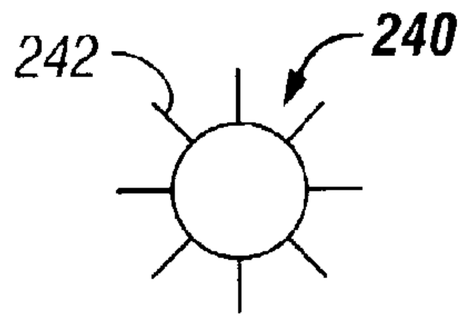


FIG. 13C

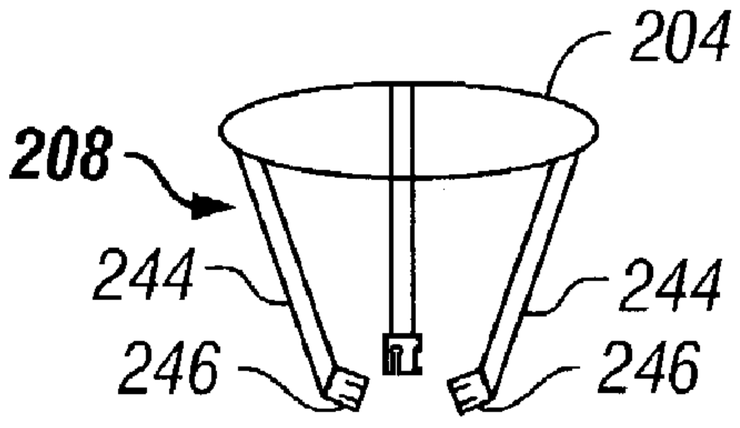


FIG. 14A

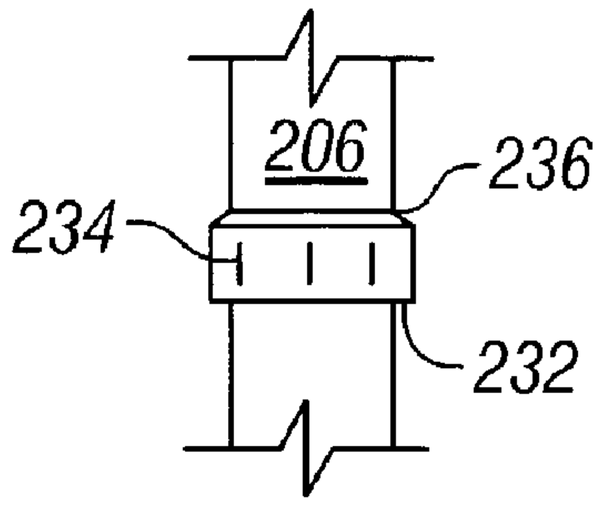


FIG. 14B

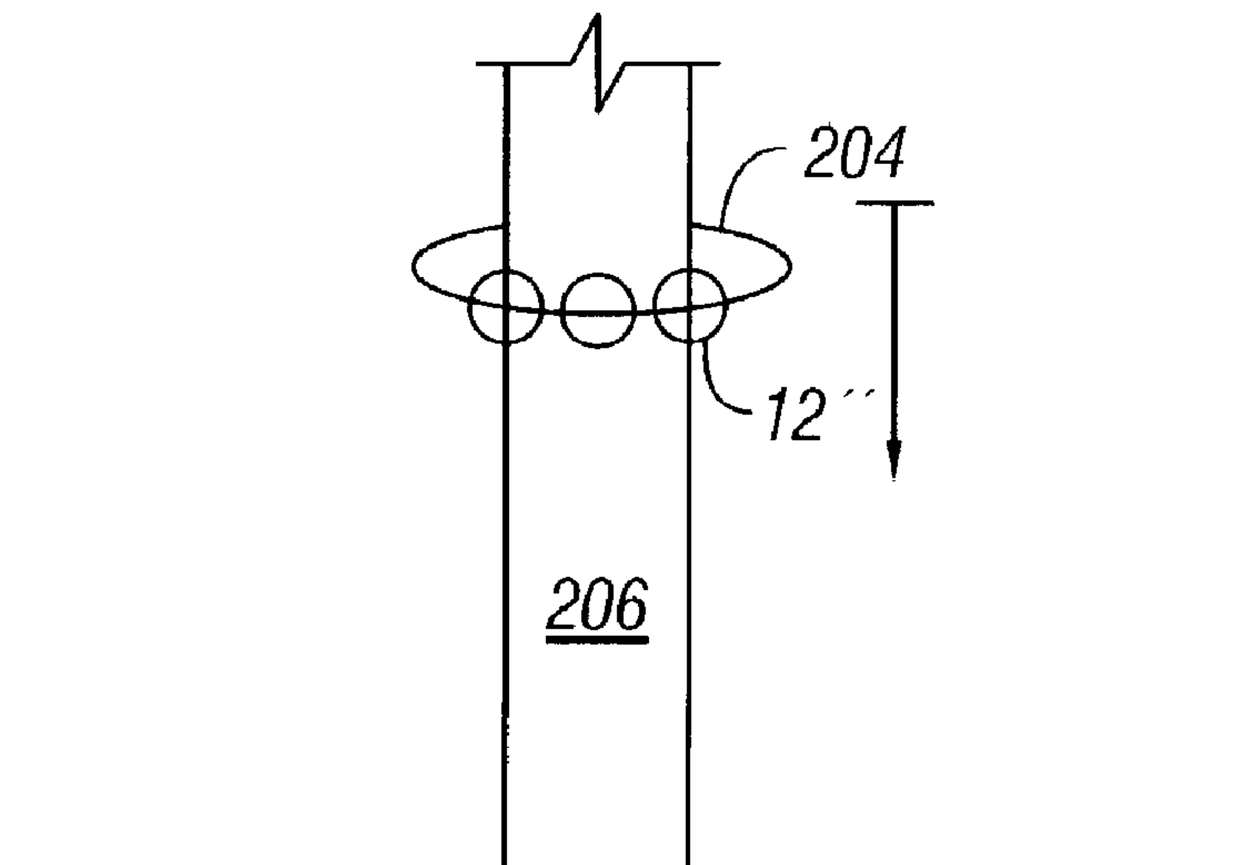


FIG. 15

ANIMAL GUARD

RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional application serial No. 60/305,815, and is incorporated herein by reference.

FIELD OF INVENTION

[0002] The present invention relates generally to animal barriers, and more particularly, to a guard utilizing a series of rotatable elements to inhibit the passage of an animal along a structure, such as a cable or pole.

BACKGROUND OF INVENTION

[0003] Animals such as squirrels and other rodents often cause extensive damage to structures that carry electricity and telecommunications signals, as well buildings that are connected to such structures. Often, a rodent will climb up support poles or fencing and along lines or cables to reach a building or electrical structure onto which they inflict damage by clawing, chewing or short circuiting a power source. Roofs and attics of a residential home, electrical transformers where a potential difference in voltage is realized, coverings for power or communications lines, and other structures are examples of locations where animals cause damage.

[0004] Various animal barriers for power lines, communications lines, poles, fencing, electrical transformers and substations, guy wires, bird feeders, and other applications have been proposed. However, such barriers have failed to fully deter squirrels or other animals from climbing up vertical structures, such as poles or fencing, or crawling along a line or wire. Additionally, these barriers are often complicated to assemble, difficult to install and expensive.

[0005] Thus, what is needed is an animal guard for generally horizontally extending structures, such as lines, cables, or fence wiring, and vertically extending structures, such as utility poles and the like, that prevents and/or discourages the animal from attempting to pass the guard. The guard would ideally be lightweight, durable, easy to install, environmentally safe and not harmful to the animal and simple in operation to provide a reliable defense against animal damage to property.

SUMMARY OF THE INVENTION

[0006] The present invention provides an animal guard with a multitude of rotatable elements that can be securely mounted on a generally vertical or horizontal structure. The rotatable elements may be of varying shapes and are designed to provide an unsteady footing for animals attempting to cross the object to continue travel along the structure. The guard may also include other deterrents to further increase the effectiveness of preventing animal passage.

[0007] In accordance with one embodiment, the animal guard is configured to surround a generally vertically-extending structure, such as a pole. A plurality of hollow rotatable elements, or "spinners", are provided with a hole formed at opposing longitudinal ends. The spinners are bifurcated into two generally equal halves that attach together. A guard plate is mounted to surround the structure and has a series of cross arm brackets which extend through the end holes of the spinners to serve as end axles for rotation and to position the spinners around the circumference of the structure. A support means secures the location of the guard plate and spinners and couples the guard plate to the structure. By this design, an animal attempting to crawl up the structure will encounter the guard plate and rotatable elements surrounding the structure and will be obstructed from physically bypassing the guard plate and achieve steady footing on the rotatable elements to continue up the structure.

[0008] Another embodiment of the animal guard is provided for inhibiting animal passage along generally horizontal structures, such as cables, lines and wires. A series of hollow rotatable spinners are provided with a hole formed at opposing longitudinal ends. The spinners are bifurcated into two generally equal halves that attach together to secure the spinners around a horizontal structure. End shields are configured with a hole extending laterally therethrough to mount the end shields onto an end section of the spinners; one end shield is positioned at each of the opposite ends of a series of spinners. A gripping means is positioned adjacent to each of the outwardly facing sides of the end shields opposite of the series of spinners to grip the horizontal structure and hold the end shields and spinners at fixed positions horizontally along the line. Additionally, the animal guard could be installed on vertical or diagonal structures, such as guy wires and the like. As with the previous embodiment, an animal desiring to cross the guard will be obstructed from passage along the structure by the end shields and will be unable to achieve steady footing on the spinners.

[0009] Thus, the animal guard inhibits the travel of animals along certain structures to prevent the animals from accessing areas where they may do damage by chewing, clawing, short circuiting a power source with their body, etc. The rotatable devices employed inhibit an animal's ability to obtain steady footing when attempting to cross the guard.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** is a side elevational view of an animal guard mounted on a horizontal line in accordance with one embodiment of the present invention.

[0011] **FIG. 2** is a side elevational view of one of the rotatable elements of **FIG. 1**.

[0012] **FIG. 3** is an exploded side elevational view of one of the rotatable elements of **FIG. 1**.

[0013] **FIG. 4** is an exploded front elevational view of one of the rotatable elements of **FIG. 1**.

[0014] **FIG. 5** is a front elevational view of one of the end barriers of **FIG. 1**.

[0015] **FIG. 6** is a side elevational view of one of the gripping means of **FIG. 1**.

[0016] **FIG. 7** is a side elevational view of the rotatable elements mounted on a fence wire in accordance with one embodiment of the present invention.

[0017] **FIG. 8** is a side elevational view of an animal guard mounted adjacent to a support in accordance with one embodiment of the present invention.

[0018] **FIG. 9** is an illustrative view of an animal guard being mounted onto the support means in accordance with one embodiment of the present invention.

[0019] **FIG. 10** is top plan view of the animal guard of **FIG. 9** mounted onto a vertical pole.

[0020] **FIG. 11** is a close-up exploded view of the guard plate of **FIG. 10**.

[0021] **FIG. 12A** is a top plan view of an animal guard having a circular axle ring and spheres mounted onto a vertical pole in accordance with one embodiment of the present invention; **FIG. 12B** is a top plan view of an animal guard having a polygonal axle ring and spheres mounted onto a vertical pole in accordance with one embodiment of the present invention; **FIG. 12C** is a top plan view of an animal guard having a ring with radially extending posts and spheres mounted onto a vertical pole in accordance with one embodiment of the present invention; **FIG. 12D** is a top plan view of an animal guard having a polygonal axle ring, spheres and a fill plate mounted onto a vertical pole in accordance with one embodiment of the present invention; **FIG. 12E** is a top plan view of an animal guard having a circular axle ring and disks mounted onto a vertical pole in accordance with one embodiment of the present invention.

[0022] **FIG. 13A** is a top plan view of the circular axle ring of **FIG. 12A**; **FIG. 13B** is a top plan view of the polygonal axle ring of **FIG. 12B**; **FIG. 13C** is a top plan view of the ring with radially extending posts of **FIG. 12C**.

[0023] **FIG. 14A** is a perspective view of the support legs in accordance with one embodiment of the present invention; **FIG. 14B** is a side elevational view of the support strap mounted onto a vertical structure in accordance with one embodiment of the present invention.

[0024] **FIG. 15** is a partial illustrative view of an animal guard of **FIG. 12A** mounted to a vertical structure.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0025] One embodiment of the animal guard of the present invention is shown generally in **FIG. 1** at **10**. The guard comprises a series of rotatable elements **12**, or "spinners", preferably hollow core, with a hole **14** formed at opposing longitudinal ends **16** and configured to surround the circumference of a generally horizontal line **100**. The term "line" as used herein refers to any elongate, generally cylindrically-shaped structure, such as a power or communications line, cable, wire, and the like. At least two end shields **18** or wheels are provided to be mounted onto the spinners **12**. One end shield **18** is ideally placed at each of the opposite ends of a series of spinners **12**. A gripping means **22** is mounted onto the line **100** adjacent to an outwardly facing side **24** of each of the end shields **18** opposite of the series of spinners **12** to grip the line and prevent the spinners and end shields from separating horizontally on the line by sliding. The guard **10** thereby obstructs the movement of an animal traveling along the line **100** because the animal is unable to achieve sure footing on the rotating elements **12** and end shields **18**. Further, the diameter of the end shields **18** ensures that the animal will not be able to leap over the whole animal guard assembly **10** to continue along the line **100**.

[0026] It should be noted that in each figure illustrating the present invention, the spinners and end shields are shown to be transparent to show the detail inside these components. However, these components may in practice be translucent or opaque and be of a variety of colors.

[0027] The spinners **12** are long, narrow shell-like objects that take the shape of an oval, football, cylinder, submarine, or any other similar shape that presents a curved outer surface **25** to an animal attempting to cross it and a low profile to minimize wind loading. Preferably, as shown in **FIG. 2**, the spinners **12** are of the submarine shape, with a center cylindrical portions **26** and conical end portions **28** having the end holes **14** formed therein. **FIGS. 3 and 4** show the bifurcation of each spinner **12** longitudinally into two generally equal shell sections **32** and has a plurality of circumferential and longitudinal ribs **34** that strengthen and increase the rigidity of the shell wall **36**. A number of weep holes or pores **38**, preferably **4**, extend through the shell wall **36** to evacuate condensation that may build up inside the spinner **12**. A number of snap-fit closures **40** are disposed proximal to the shell wall edge **42**, each closure **40** of one shell section **32** being received by an aligned, mating closure on the mating shell section, as shown in **FIGS. 3 and 4**, to form the complete spinner **12**. The closures **40** are preferably formed of a barb and slot connection. Each shell section **32** has a semi-circular end trough **43** that mates with the channel of a mating shell section to form the end hole **14**. When mounting the spinners **12** on an installed line **100**, such as a telephone line or electrical transmission line, two mating shell sections **32** are aligned horizontally **100** along the line such that when the sections are snapped together on the line, the end holes **14** circumscribe the line and may spin freely thereon.

[0028] The spinners **12** are preferably made of UV resistant, injection moldable plastic, such as polypropylene. Extra animal deterrent qualities are gained by making the rotatable elements with a textured surface or fins **44** to make in uncomfortable for an animal to grip and apply weight while attempting to navigate a crossing of the guard, and by coloring the rotatable elements red and including coyote or fox urine scent, or other deterrents in the plastic for injection molding. The other deterrents may include items that present a bad taste or smell to the animal (i.e., irritants) without affecting the health or reproductive cycle of the animal, such as organics like cinnamon oil or cayenne pepper, discouraging an animal from touching and/or chewing through any components of the animal guard **10** injection molded with the deterrents. However, it is to be understood that any variety of colors may be used that are known as a deterrent, or colors that are environmentally pleasing for the end user.

[0029] Exemplary dimensions of the spinners **12** are a maximum diameter of 4 to 12 inches and a length of 12 to 24 inches, preferably a diameter of 4 inches and a length of 12 inches. These sizes are effective to prevent most crawling animals, such as squirrels, from maintaining their balance while attempting to cross the spinners **12**, but sufficiently small as to not induce an excessive weight or wind load on the line **100**. The end holes **14** are dimensioned to circumscribe typical line diameters, such as 1, 2 or 3 inches. Preferably, the end holes **14** are pre-formed with a 1 inch diameter, and each spinner **12** has a circumferential cutaway groove **45** designating the location where the spinner can be cut along the groove to form the end hole with a 2 or 3 inch

diameter. When the spinners **12** are mounted on an electrical transmission line **100**, they can also be equipped with electromagnets (not shown) such that when the rotatable elements spin due to wind loads on the fins **44**, electrical current is generated along the line to reduce loss.

[**0030**] The benefit of mounting the spinners **12** on a horizontal axis is that rotation about an axis in the horizontal plane forces the animal attempting to crawl over the spinners to encounter a downward rotation of each of the spinners weighted by the animal on either side of the horizontal line **100** for the entire length of the spinner. Each end hole **14** is generally centered in the transverse cross-sectional plane of the spinner **12**, as shown in **FIG. 4**, to form an axis of rotation about which the spinner is generally evenly weighted. This ensures that an animal will have a difficult time balancing on the spinners **12** and avoiding rotation. Further, the curved outer surface **25** of the spinners **12** makes it difficult for an animal to grip the spinner when attempting to traverse the horizontal line **100**.

[**0031**] **FIG. 5** shows the preferred configuration for the end shields **18**. The end shields **18** serve a number of purposes. First, the end shields **18** secure the series of spinners **12** to a narrow range of positions along a horizontal line **100**, as seen in **FIG. 1**, such that the spinners do not become unduly separated horizontally along the line when wind loads are induced. Separation could allow an animal to leap over individual spinners **12** without having to embrace an entire series of spinners all at once. Additionally, because of their relatively large diameter, the end shields **18** prevent an animal from attempting to leap over a series of spinners **12** to travel further down the horizontal line **100**. Further, the end shields **18** increase the difficulty of an animal attempting to slowly crawl onto a spinner **12** and balance the spinner without rotating it. With the shield **18** in place, the animal has to come off of the shield at a position vertically above or below the spinners **12**, making it difficult to grip a spinner without causing it to rotate.

[**0032**] The end shields **18** generally take the form of a jump disc or wheel having a hole **46** defined by a center ring **48** with radially extending spokes or ribs **50** extending from the center ring supported by a number of concentric outer rings **52**. A radial installation slot **54** extends from the center ring **48** to the outer-most outer ring **52**, bisecting one of the spokes **50**, to allow the shield **18** to be flexed laterally or tangentially to open the hole **46** such that the shield may be slipped over the conical end portion **28** of the spinners **12** for mounting thereon. In this fashion, the conical end portion **28** can also be referred to as a shield or wheel mounting ledge. Preferably, the closures **40** protrude above the spinner outer surface **25** to provide an interference fit with the center ring **48** of the end shield **18** when the shield **18** is unflexed after being slipped over the conical end portion **28** such that the shield is rigidly positioned on the spinner **12**. A tie strap (not shown) or similar item can be tied around the spoke **50** that is bisected by the radial slot **54** to hold the end shield **18** to its circular shape and maintain its structural integrity.

[**0033**] The end shields **18** are generally much thinner in the lateral direction than the spinners **12** and have a diameter larger than the spinners to restrict access thereto by animals crawling along the line. Preferably, the end shields **18** have a diameter of about 12 inches to provide an effective animal barrier. The end shields **18** may also be made of UV resistant, injection moldable plastic, such as polypropylene, with the same animal deterrent features as described above for the spinners **12**.

[**0034**] The spoked arrangement of the shields **18** generates a reduced wind load and weight on the line **100** as compared to a solid disk. The spokes **50** should be sufficiently close together along the circumference of the center ring **48** and outer rings **52** as to prevent an animal from crawling between the spokes to reach the spinners **12**.

[**0035**] The gripping means **22** is installed to abut the series of spinners **12** and end shields **18**, as shown in **FIG. 1**. The gripping means **22** could include any type of clamp, catch or similar device, and preferably is a L-shaped bracket clamp fixedly attached to the line **100** to prevent the spinners **12** and end shields from spreading horizontally along the line **100**. The details of the clamp **22** are best seen in **FIG. 6**. The base arm **58** of the clamp has a pair of raised slots **60** through which wire-ties (not shown) or similar tie straps may be extended and wrapped tightly around the line **100** to compress the clamp **22** against the line **100** to prevent movement thereof. The clamp **22** is aligned such that the vertical arm **62** abuts the spinner **12** and the base arm **58** rests on the line **100** with the slots **60** aligned perpendicular to the horizontal direction of the line. As with the end shields **18**, one clamp **22** is positioned at each of the opposite ends of the series of spinners **12**, as seen in **FIG. 1**. Preferably, the clamp **22** is made of UV resistant, injection moldable plastic, such as polypropylene, with the same animal deterrent features as described above for the spinners **12**.

[**0036**] If the guard **10** of the present invention is to be installed sufficiently close to an end support **102** of the line **100**, such as a fence post or a transmission line support, one of the clamps **22** may be omitted and the support **102** may serve to prevent the separation of the spinners **12** in one longitudinal direction along the line. The opposite clamp **22** would then prevent spinner **12** separation in the opposing longitudinal direction.

[**0037**] In an exemplary embodiment where the animal guard **10** is used on horizontal fencing wire, or a similar arrangement, the wire **100** surrounded by the spinners **12** must be a smooth wire. **FIG. 7** shows a fence **104** with fence post arm supports **102** at each end of the wire **100**. The barbed wire that is to have rotatable elements mounted thereon must be removed and replaced with smooth wire **100** to allow the spinners **12** to freely spin around the longitudinal axis of the wire **100**. Additional wires may have to be removed to allow sufficient clearance for the spinners **12** to spin without contacting adjacent wires. Ideally, enough spinners **12** should be placed on the wire **100** such that the rotatable elements extend from one fence post arm **102** to another with only a small clearance at each end. The preferred clearance above and below the spinners **12** to adjacent wires or fencing is about one-half of an inch. The supports **102** serve as an end blocks to keep the spinners **12** from sliding along the wire **18** due to wind loads, or alternatively, the gripping means **22** may be placed at each end of the series of spinners as shown in **FIG. 8**. In this arrangement, an end shield **18** is essentially unnecessary because the animal is typically attempting to climb up the fence and over the wire **100** and spinners **12** to access a forbidden area, instead of merely crawling horizontally along the wire and animal guard components. When an

animal attempts to grip the spinners **12** from below, they spin in the downward direction, making them difficult to climb over.

[**0038**] For using the present invention on horizontal power or communications cable or lines, or any other horizontal line or wire arrangement where vertical supports **102** are spaced far apart, the arrangement of the spinners **12** and end shields **18** is provided. First, the base **58** of the L-shaped clamp **22** is affixed to the line **100** with the wire-ties near the point desired to be protected. The desired number of spinners **12** are then mounted onto the line **100** by snapping together each of the two mating shell sections **32**. The number of spinners **12** chosen should take into account the space available on the line **100** between supporting structures, the distance necessary to keep animals from attempting to jump over the spinners, and the additional weight that the present invention adds to the line, among other factors. If the line **100** has a diameter of greater than 1 inch, the spinners **12** can be cut along the circumferential grooves **45** to form each of the opposing end holes **14** with a 2 or 3 inch diameter. The end shields **18** are then placed on the first and last spinners **12** of the series (e.g., at opposite horizontal ends of the series), by flexing the shields laterally or tangentially to open the hole **46** and slipping the center ring **48** over the conical end portion **28** of the spinners **12**. Preferably, the center ring **48** is slid past the protruding closures **40** of the spinners **12** to provide an interference fit such that the shield **18** is rigidly positioned on the spinner **12**. A tie strap is tied around the spoke **50** that is bisected by the radial slot **54** to hold the end shield **18** in place. Finally, a second L-shaped clamp **22** is installed on the opposite end of the series of spinners **12** to hold the assembly from sliding apart horizontally along the line **100**.

[**0039**] The elements of the animal guard **10**, including the spinners **12**, end shields **18**, and gripping means **22**, for mounting to a horizontal structure can also be secured to non-horizontal lines of a power transformer or other electrically charged object so long as any electrically conductive elements of the invention are either spaced away from the "live" transformer elements or are touching an insulator. If the spinners **12** and shields **18** are made of plastic, they can be placed in contact with such "live" elements as long as they are not exposed to excessive heat and are of the type of plastic that would not initiate an electrical or corona discharge with the transformer elements.

[**0040**] In an embodiment for securing the animal guard **150** of the present invention to a generally vertical structure **154**, such as a utility pole, a series of spinners **12**N, preferably having the same configuration as the spinners **12** mounted to the horizontal line **100**, are provided to surround the perimeter of the pole **154** for obstructing the movement of an animal climbing up the pole, as seen in **FIG. 9**. The rotatable spinners **12**N have a two-piece bifurcated design with a hole **156** formed at opposing longitudinal ends **158**, essentially identical to the spinners **12** of FIGS. **2-4**. A guard plate **160**, as shown in **FIG. 10**, is configured to be mounted to surround the pole **154** and provides supports **162** about which the spinners **12**N are rotatably mounted. A support means **163** secures the guard plate **160** to the pole **154**.

[**0041**] **FIG. 11** shows the detail of the guard plate **160**, having a generally circular inner ring **164** concentric with the shape of the perimeter of the pole **154** being surrounded. The inner ring **164** may have a cutout portion (not shown) through which a conduit or other object may extend vertically up the pole **154**. Preferably, the ring **164** geometry should be such that no more than about a one inch gap is form between the plate **160** and the pole **154**. The guard plate **160** also has a main body section **165** with a plurality of holes **166** through which other conduits may be extends up the pole **154** depending on the needs of the user. Also, the holes **166** allow moisture to pass through to minimize water or ice accumulation on the main body **165** of the plate. Slots **167** are also provided in the body section **165** to allow tie-straps and the like to secure the guard plate **160** on the support means **163**.

[**0042**] The supports **162** extending radially outward from the body section **165** of the guard plate **160** and form cross arm brackets **170** each having two generally opposing axle arms **172**. Braces **173** are provided to support the brackets **170**. The axle arms **172** have a circular cross-section and serve as a horizontally-aligned axle about which the spinners **12**N rotate, as shown **FIG. 10**. The benefit of mounting the spinners **12**N on horizontal axle arms **172** is that rotation about an axis in the horizontal plane forces the animal attempting to climb over the spinners to encounter a downward rotation, the opposite direction of where they need to go to bypass the guard **150**. Each of the opposing holes **156** of a spinner **12**N are mounted to one axle arm **172** such that two adjacent cross arm brackets **170** are needed to mount one spinner **12**N. The spinners **12**N mount onto the axle arms **172** in the same fashion as the spinners **12** mount onto the horizontal line **100** configuration. In a preferred arrangement shown in **FIG. 10**, each guard plate **160** has seven spinners **12**N and seven cross arm brackets **170**. The shape of an outer perimeter **174** of the plate **160** is such that only a small gap is formed between the spinners **12**N and the plate **160**, preferably about an inch or less.

[**0043**] The guard plate **160** preferably is fabricated as a two-piece design that is split into generally semi-circular pieces **176**. A set of connectors **178** extend from the radial edges **180** of opposing semi-circular pieces **176** to mate with one another and rigidly couple the pieces together. In one embodiment, the connectors **178** may include vertically-aligned loops (not shown) that are configured to overlap one another such that tie-straps, rivets, or similar items may be extended therethrough for coupling the pieces **176** together. Alternatively, tie-straps may be extended through the holes **166** or slots **167** of the opposing semi-circular pieces **176**.

[**0044**] The guard plate **160** may be made of a variety of materials, and preferably is made of an acetyl resin possessing high impact strength properties and UV resistance. Both the guard plate **160** and spinners **12**N may have the same animal deterrent features as described above for the spinners **12**, including taste, smell and sign irritants and/or deterrents to animals, such as squirrels and other rodents. Additionally, the guard plate **160** is preferably sized such that when the spinners **12**N are removed from the plate, the radial dimension from the inner ring **164** to the outer perimeter **174** at a location away from the cross arm brackets **170** is only about 4½ inches. This allows a utility worker climbing the pole **154** to easily climb around the animal guard **150** to move higher up the pole to, for example, service transmission lines or transformers. The animal guard **150** should also be mounted a sufficient distance up the pole **154** such that an animal cannot jump from the ground onto the pole **154** at a

location above the guard, and such that the guard is not disturbed by passing machinery and the like. Preferably, the animal guard **150** is mounted at least 12 feet above the ground level.

[**0045**] The inner ring **164** of the guard plate **160** is optimized for use with vertical pole **154** having a diameter of about 10 to 12 inches. If the animal guard **150** is desired for use with a smaller diameter structure, a properly sized flex conduit (not shown) can be inserted between the inner ring **164** and structure **154** to fill the gap G therebetween. The support means **163** can be any configuration that will rigidly couple the guard plate **160** to the pole **154**, and preferably includes a set of pole mounting spikes or screws either driven or threaded into the pole **154** and extending radially outward therefrom. After the semi-circular guard pieces **176** are assembled together around the pole **154** to form the guard plate **160** with the spinners **12**N mounted thereon, the entire assembly **184** is lowered onto the spikes **163**, as shown in **FIG. 9**. The plate **160** could have a series of radial grooves (not shown) formed onto an underside of the plate such that the spikes **163** would fit into the grooves. Preferably, tie-straps (not shown) are extended through adjacent slots **167** and underneath the spikes **163** and firmly tied to attach the assembly **184** to the spikes and prevent rotation of the assembly around the pole **154**.

[**0046**] It is also to be understood that the animal guard **150** of the present invention may work with structures having a polygon cross-section in addition to those of a circular configuration. In this way, the inner ring **164** of the guard plate **160** would preferably have a polygon shape as an alternative to a circular configuration, to minimize gaps where an animal could climb between the guard plate **160** and the structure **154**.

[**0047**] In an alternative arrangement of the present invention, the animal guard **200** does not have a guard plate **160**, and the rotatable spinners **12**O are mounted on an axle **204** circumscribing a vertical structure **206**, such as a utility pole, to leave only a small gap between the spinners and the structure, as shown in **FIGS. 12A through 12E**. The spinners **12**O may be the same as the spinners **12**N of the previous embodiment, but preferably have a spherical or disk-like shape. Alternatively, the spinners **12**O could be formed with a center hole or bore **207** extending therethrough to mount such elements on the axle **204**. The bore **207** is generally centered through the spinner **12**O to form an axis of rotation about which the spinner is evenly weighted. This ensures that an animal will not be able to balance on the spinner **12**O and avoid rotation unless it is directly above or below the axis of rotation, which is nearly impossible for an animal attempting to grip rotatable elements to climb over them. A support means **208** is also provided to secure the spinners **12**O and axle **204** to the pole **206** while ensuring the free, uninhibited rotation of the spinners when gripped by an animal. Preferably, the animal guard **200** is mounted at least 12 feet above the ground level, as illustratively shown in **FIG. 15**.

[**0048**] For the configurations shown in **FIGS. 12A through 12D**, the spinners **12**O are preferably hollow spheres that can be provided with a textured surface to make in uncomfortable for an animal to grip and apply weight while attempting to climb over the animal guard **200**. However, the spinners **12**O could also take the shape of a cylinder, oval, submarine, football, or any other configuration presenting a significant portion with a curved surface, such as the disks of **FIG. 12E**. The spinners **12**O are spaced apart on the axle **204**, and laterally away from the pole **206**, a sufficient distance as to provide clearance for the elements to rotate freely. It should be recognized, though, that the spinners **12**O are not spaced so far apart from each other and away from the pole **206** that an animal would be allowed to climb around the elements to reach a higher area. Preferably, the axle **204** is mounted such that the spinners **12**O are spaced about one-half to one inch from the pole **206** at the closest location. The spinners **12**O are also preferably made of injection molded, UV resistant plastic having a shell thickness of about one-eighth of an inch. When the spinners **12**O are spheres, the preferably range in diameter from 5 inches to 6.5 inches depending on the type of axle **204** used, although the diameter of the spheres can be much larger or smaller depending on what size is needed to surround pole **206** of various widths. The spinners **12**O may have the same animal deterrent features as described above for the spinners **12**, including taste, smell and sign irritants and/or deterrents to animals, such as squirrels.

[**0049**] Various configurations for the axle **204** are shown in **FIGS. 13A and 13B**. The axle **204** may take the shape of a circular ring **210** or polygonal ring **212**, for example. The rings **210**, **212** should be of a diameter as to position the spinners **12**O around the pole **206** and at the correct distance therefrom. Additionally, the selection of the number of straight sections **214** or "sides" of the polygonal ring **212** depends on the size of the spinners **12**O and the desired distance to position the spinners from the pole **206**.

[**0050**] The circular ring **210** preferably comprises two generally half-circle aluminum rods **216** each configured to span **180** degrees around the perimeter of the post **206** and connected together with a hinge **220** at one end, and with a hook and spring system **222** at the opposing ends. The polygonal ring **212** comprises two half-polygon aluminum rods **224** each generally spanning around the pole **206** in the same fashion and connected together with a hinge **226** at one end, and with a hook and eyelet system **228** at the opposing ends. The hinges **220**, **226** may be rivet or pin type, or any other similar arrangement.

[**0051**] If it is desired to position the spinners **12**O further away from the perimeter of the pole **206** such that it would be more difficult for an animal to climb around them, a fill plate **230** may be positioned below the elements, as shown in **FIG. 12D**. The fill plate **230** surrounds the pole **206** and extends radially outward therefrom a sufficient distance as to block an animal from climbing between the structure and the spinners **12**O. Alternatively, the fill plate **230** could be positioned at the same vertical height as the spinners **12**O and be shaped as to substantially fill any gaps formed between the elements and the pole **206** perimeter, and between each of the elements inside of the perimeter formed by the axle **204** (i.e. preferably leaving only about a one-half inch gap). The fill plate **230** is supported from beneath by a support strap **232** mounted on the pole **206**, as shown in **FIG. 14B**. The strap **232** is preferably a plastic strap that is secured to the pole **206** with a number of radially, inwardly-extending pole spikes **234** located at various positions around the circumference of the strap. The strap **232** has an upper tapered edge **236** that matches the inside diameter of the fill plate **230** such that the plate rests securely on top of

the strap. Preferably, the strap **232** is around 4 inches in height and has an inside diameter sufficient to extend around the pole **206**.

[**0052**] Another axle **204** configuration is shown in **FIGS. 12C and 13C**. The axle **204** comprises a circular ring and post roller assembly **240**. The assembly **240** is similar to the circular ring **210**, but adds radially extending posts **242** which are inserted into the bores **207** of the spinners **12**O.

[**0053**] In another configuration shown in **FIG. 12**E, the spinners **12**O comprise thin disks that have a flat shape in the radial plane of a circle, square, pentagon, star, or any other shape that can rotate uniformly around an axle **204**. A sufficient number of disks are provided to ensure that a viable obstruction is in place for animals attempting to climb through the disks along the pole **206** or to grip the disks to move higher up the structure. As with the other spinners **12**O, the disks can be provided with a textured surface to make in uncomfortable for an animal to grip and apply weight while attempting to climb over the animal guard **200**. The disks are spaced apart on the support axle **204**, and laterally away from the pole **206**, a sufficient distance as to provide clearance for the disks to rotate freely. The disks are also of a sufficient diameter as to provide a high rotational force if an animal attempts to grip the disks to move higher up the pole **206**. Preferably, the disks have a diameter of about 7 inches and are spaced on the ring about one-half inch from the pole **206** at the closest location. As with the other spinners **12**O, the diameter of the disks can be much larger or smaller depending on what size is needed to surround poles **206** of various widths. The same animal deterrents used in the other spinners **12**O, namely red color and coyote or fox urine scent, can be used in the disks to serve as an added deterrent to animals. However, it is to be understood that any variety of colors may be used that are known as a deterrent, or colors that are environmentally pleasing for the end user. The disks are preferably injection molded UV resistant plastic having a shell thickness of about one-eighth of an inch.

[**0054**] As shown in **FIG. 14**A, the support means **208** is provided to mount the animal guard **200** to the pole **206**, preferably comprises a plurality of support legs **244** extending downward from the axle **204**. Each support leg **244** has a spike **246** or similar means to attach to the pole **206**, such as a wooden utility pole. The legs **244** are preferably at least 18 inches long to provide a sturdy support for the axle **204** and spinners **12**O. Ideally, three legs are provided. Additionally, the legs **244** can also be hingedly attached to axle **204** to allow for easy installation and removal of the legs from the pole **206**. As an alternative to support legs **102**, other support means **208**, such as bolts or other fasteners, may be welded or otherwise connected to the support axle **204** to mount the axle to the pole **206** to support the axle and spinners **12**O.

[**0055**] The present invention thus attains improved performance and reliability in an animal guard, impeding the travel of animals, such as rodents, along various structures. Since certain changes may be made in the above apparatus without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. It is also to be understood that the following claims are to cover all generic and specific features of the invention described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall there between.

What is claimed is:

1. An animal guard configured to extends around the perimeter of a vertically-extending structure, comprising:

a guard having a body section and a series of axle arms spaced radially outward therefrom and forming a series of axle axes, the guard configured to extend circumferentially around the vertically-extending structure;

a series of rotatable elements, each element configured to accept opposing axle arms at opposite sides thereof for rotation about the axle axes; and

support means for mounting the guard to the vertically-extending structure.

2. The animal guard of claim 1, wherein each rotatable element comprises two mating shell sections each having connectors disposed along a shell wall for coupling the sections together to form a rotatable element, and having a trough at opposing ends of each shell section to form a hole with a mating shell for extending around the axle arms for rotation thereabout.

3. The animal guard of claim 1, further comprising cross arm brackets extending radially outward from the body section, each cross arm bracket having two generally opposing axle arms extending laterally therefrom to space the rotatable elements generally adjacent to and radially outward from the body section of the guard.

4. The animal guard of claim 1, wherein the body section of the guard has a plurality of holes sized and configured to allow conduits to be extending through the guard generally parallel to the vertically-extending structure

5. The animal guard of claim 1, wherein at least the body section of the guard is made of acetyl.

6. The animal guard of claim 1, wherein the support means comprises a plurality of spikes configured to extend radially from the vertically-extending structure such that the guard may rest thereon.

7. The animal guard of claim 1, wherein the rotatable elements are red in color to deter animals from crossing the guard.

8. The animal guard of claim 1, wherein the rotatable elements are made of a UV resistant plastic and impregnated with at least one of coyote urine and fox urine scent to deter animals from crossing the guard.

9. An animal guard configured to extends around the perimeter of a vertically-extending structure, comprising:

a plurality of rotatable elements each having a bore;

an axle extending through the bores of the plurality of rotatable elements to form an axis about which the plurality of rotatable elements may rotate, the axle forming a ring substantially circumscribing the vertically-extending structure; and

support means to secure the axle to the structure;

wherein the axle axis is aligned generally orthogonal to the vertical axis of the structure.

10. The animal guard of claim 9, wherein the support means comprises a plurality of legs extending downwardly

from the axle, each leg having a spike to contact the vertically-extending structure and maintain the position of the leg.

11. The animal guard of claim 9, wherein the axle ring is circular in shape.

12. The animal guard of claim 9, wherein the axle ring is polygonal in shape.

13. The animal guard of claim 9, wherein the axle comprises first and second rod sections pivotably attached together at a hinge, the first rod section having a hook at an end opposite the hinge and the second rod section having a receiver at an end opposite the hinge for receiving the hook to form the axle into a closed ring.

14. The animal guard of claim 9, further comprising:

a support strap configured to substantially circumscribe the vertically-extending structure and having a series of radially inwardly-extending spikes to contact the structure and maintain the position of the strap proximal to the plurality of rotatable elements; and

a fill plate configured to rest upon the support strap and inhibit the ability of an animal to bypass the plurality of rotatable elements as the animal is moving upward along the vertically-extending structure.

15. An element configured to rotate about an axis, comprising a pair of mating shell sections each having connectors disposed along a shell wall for coupling the sections together to form a rotatable element, and each section having troughs formed into the shell walls at opposing ends to define a hole with a mating shell for extending around a horizontally-extending structure for rotation thereabout.

16. The element of claim 15, wherein the shell sections have a center cylindrical portion and a pair of conical end portions disposed on opposite longitudinal sides of the center cylindrical portion, and at least one concentric groove formed into the shell wall of each of the conical end portions to designate a location for severing a portion of the conical end portions to enlarge the holes for accepting the horizontally-extending structure through the rotatable element.

17. An animal guard configured to extend around the perimeter of a horizontally-extending structure, comprising:

a series of rotatable elements configured to accept a horizontally-extending structure therethrough for rotation about the structure; and

a pair of end barriers each having a center ring sized and configured for insertion over one of the rotatable elements for mounting thereon; and

a gripping means configured for mounting on the horizontally-extending structure to prevent the rotatable elements from separating longitudinally along the structure;

whereby one end barrier is mounted on each of the opposite horizontal ends of the series of rotatable elements and the gripping means is mounted adjacent to each of the end barriers.

18. The animal guard of claim 17, wherein at least two of the elements have a center region and an end region with a transverse cross-sectional dimension less than that of the center region, the end region configured to accept the end barrier for mounting thereon.

19. The animal guard of claim 17, wherein each rotatable element comprises two mating shell sections each having connectors disposed along a shell wall for coupling the sections together to form a rotatable element, and having a trough at opposing ends of each shell section to form a hole with a mating shell for extending around the horizontally-extending structure for rotation thereabout.

20. The animal guard of claim 17, wherein the end barriers further have a plurality of radially extending spokes extending from the center ring and at least one outer ring interconnecting the spokes with a radially extending slot extending from the center ring to an outer perimeter of the end barrier to allow for expansion of the center ring upon the application of a lateral or tangential force such that the center ring can be extended over a portion of the rotatable element having a larger diameter than the unexpanded center ring for mounting thereon.

21. The animal guard of claim 17, wherein the rotatable elements are red in color to deter animals from crossing the guard.

22. The animal guard of claim 17, wherein the rotatable elements are made of a UV resistant plastic and impregnated with at least one of coyote and fox urine scent to deter animals from crossing the guard.

23. The animal guard of claim 17, wherein the horizontally-extending structure is an electrical transmission line, and wherein the rotatable elements further have fins and electromagnets disposed thereon, whereby the fins facilitate the spinning of the rotatable elements around the transmission line upon receiving a wind load to allow the electromagnets to work with the line carrying electrical current to generate a magnetic field to reduce loss along the line.

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