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(54) **DEVICE TO DEPLOY RAPIDLY AND COVER STADIUM AND OPEN SPACE TO COLLECT RAINFALL**

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CPC ... *E04H 3/14* (2013.01); *E04B 7/16* (2013.01)

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(57) **ABSTRACT**

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A device, system and method to deploy rapidly and cover open space and stadium to collect flash rainfall thereby protect the event from disruption, protect people and objects from rain water, and having ability to manage wind with device comprising of rain collection strips, support tower cable support arm with strip guide, cable connector on arm, drive for collection strips and control cables, drainage unit, camera and computer. The device having wide scope for use in political meeting, open air theatres, rain sensitive crops like grapes and with the device being low on infrastructure cost, with the above device protecting people and events which so far has been tolerated quietly by people and organizers of events due to flash rains. Getting correct cover surface shape configuration and profile to manage problem of wind is the solution offered by the invention.

(21) Appl. No.: **14/392,014**

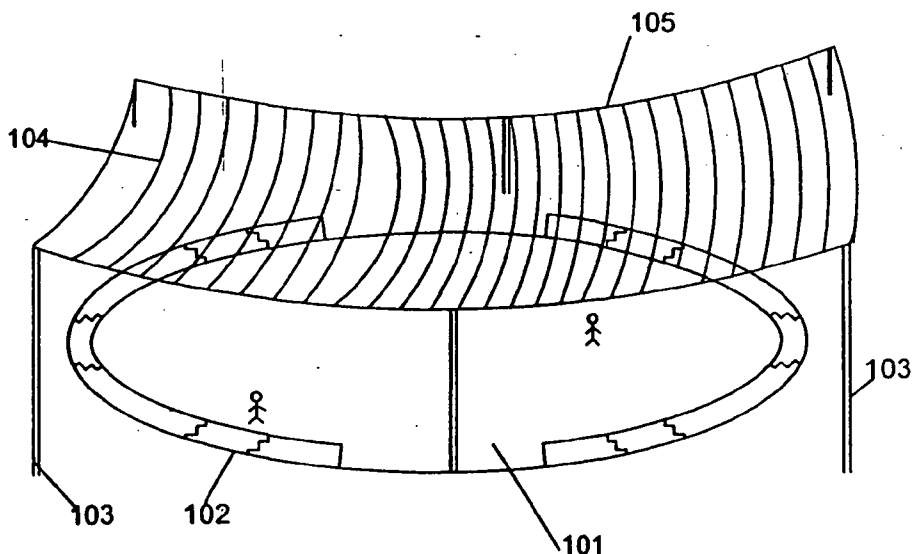
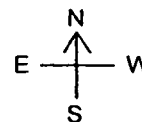
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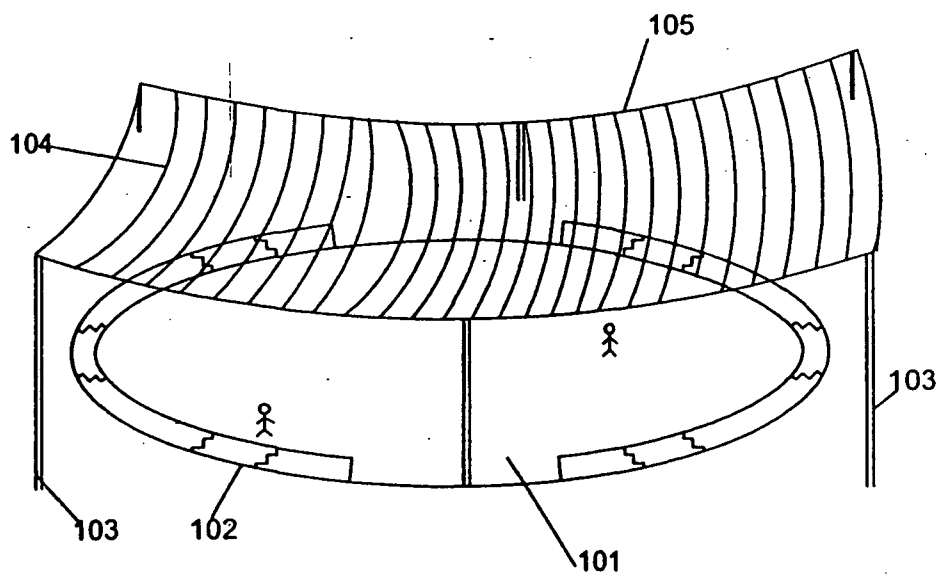
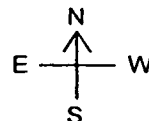


FIGURE -1

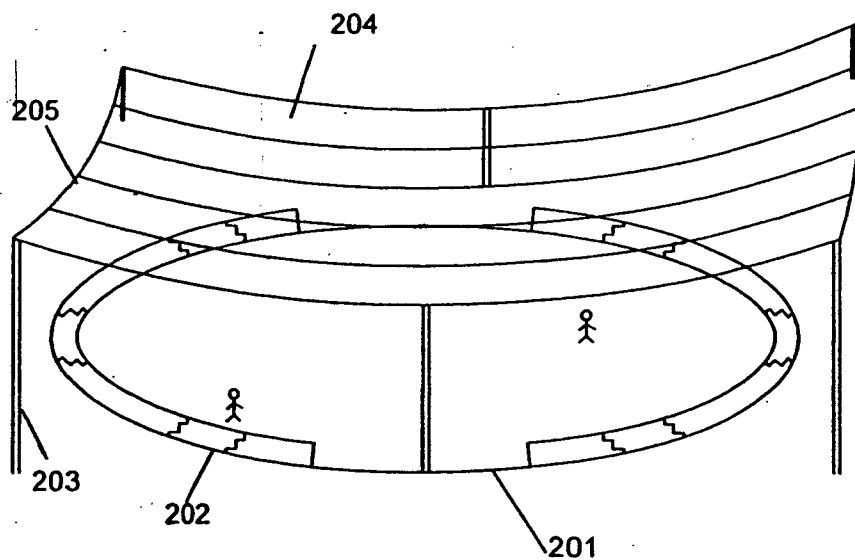
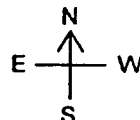


FIGURE -2

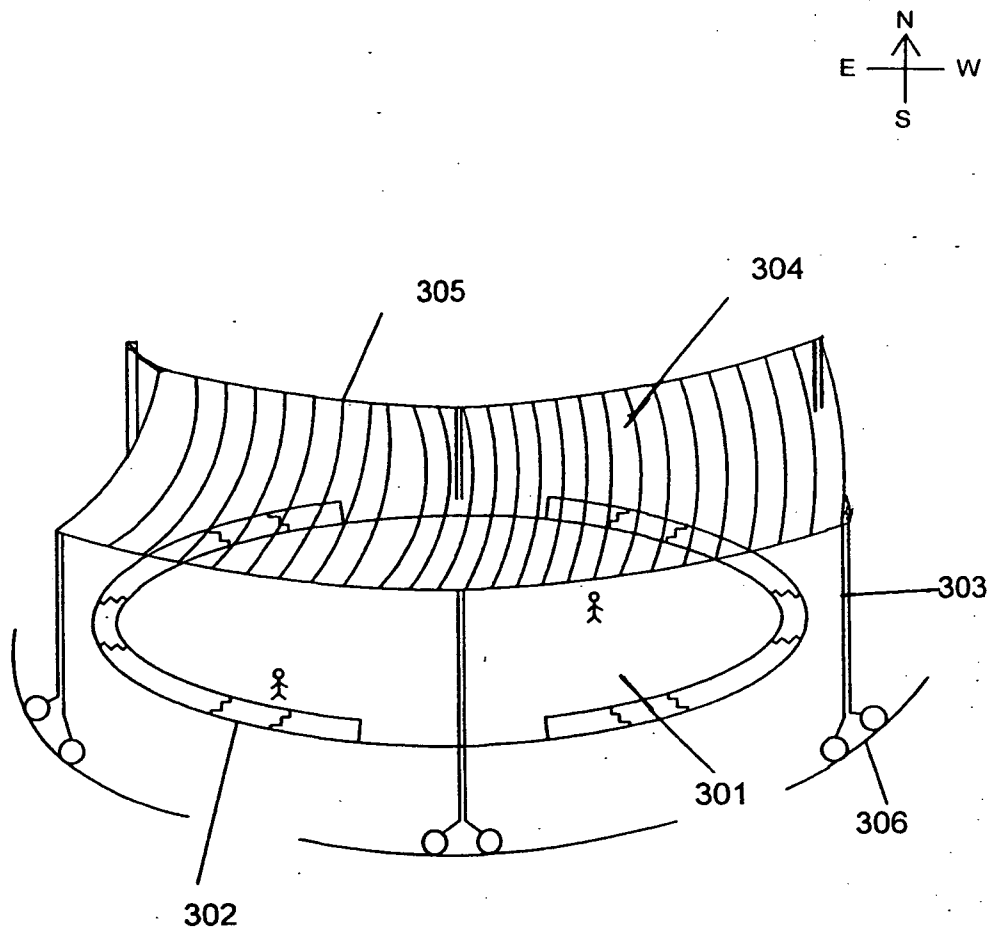


FIGURE - 3

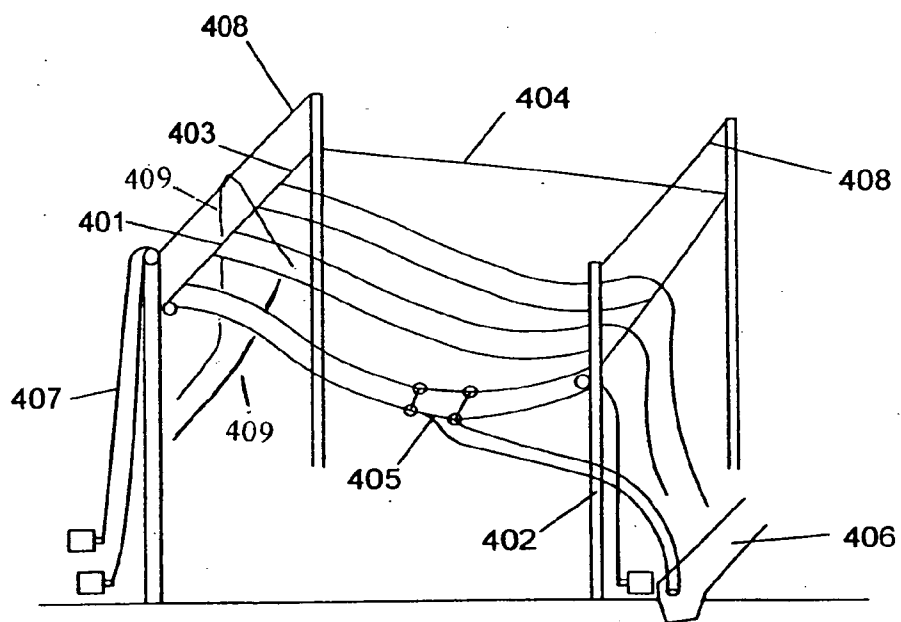


FIGURE - 4

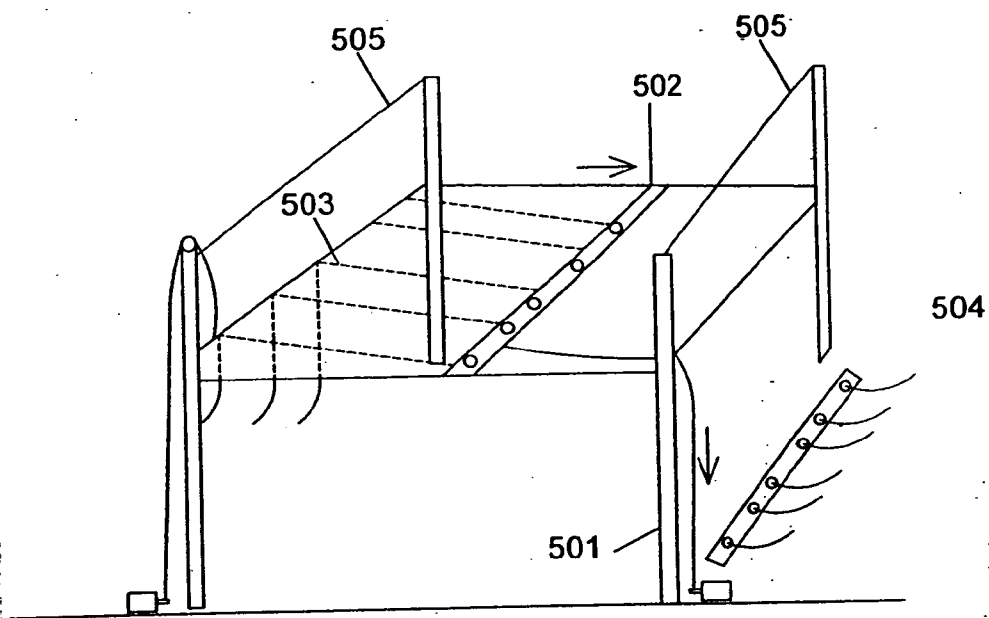


FIGURE - 5

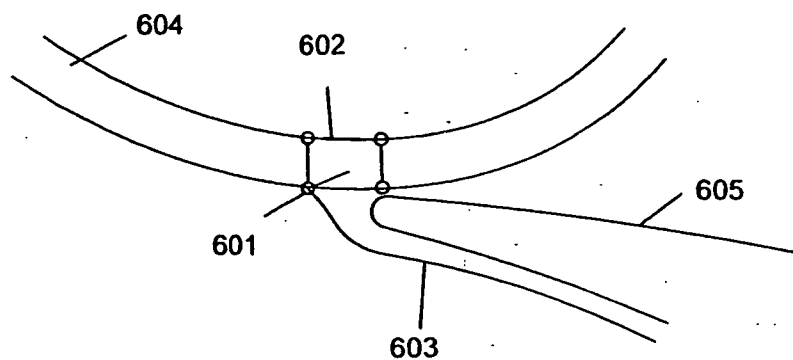


FIGURE - 6 |

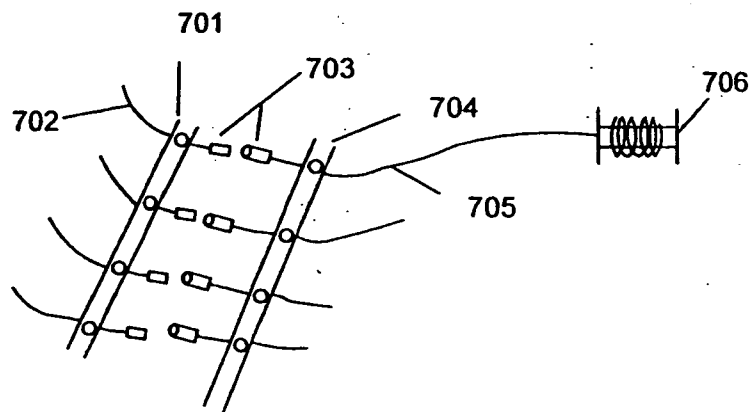


FIGURE - 7 |

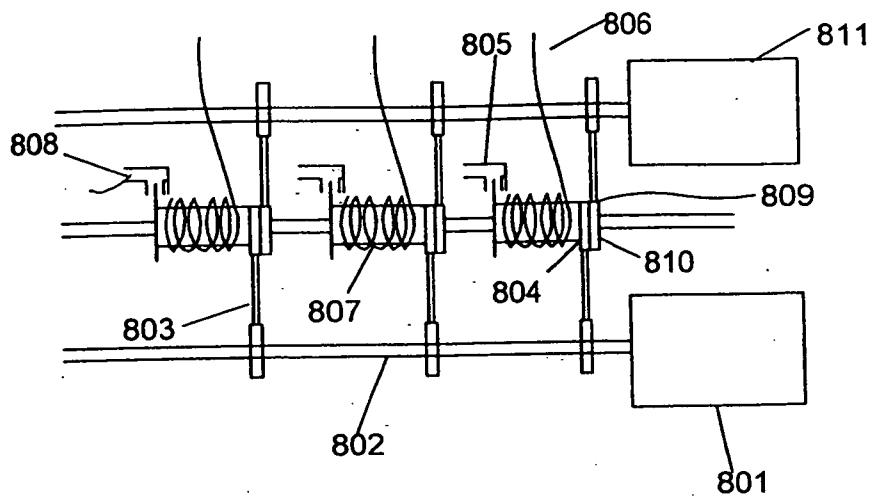


FIGURE - 8

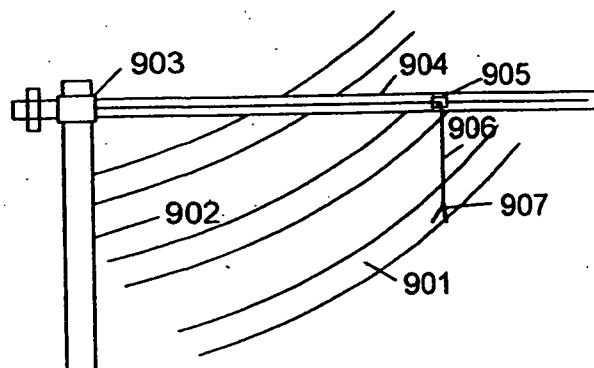


FIGURE - 9

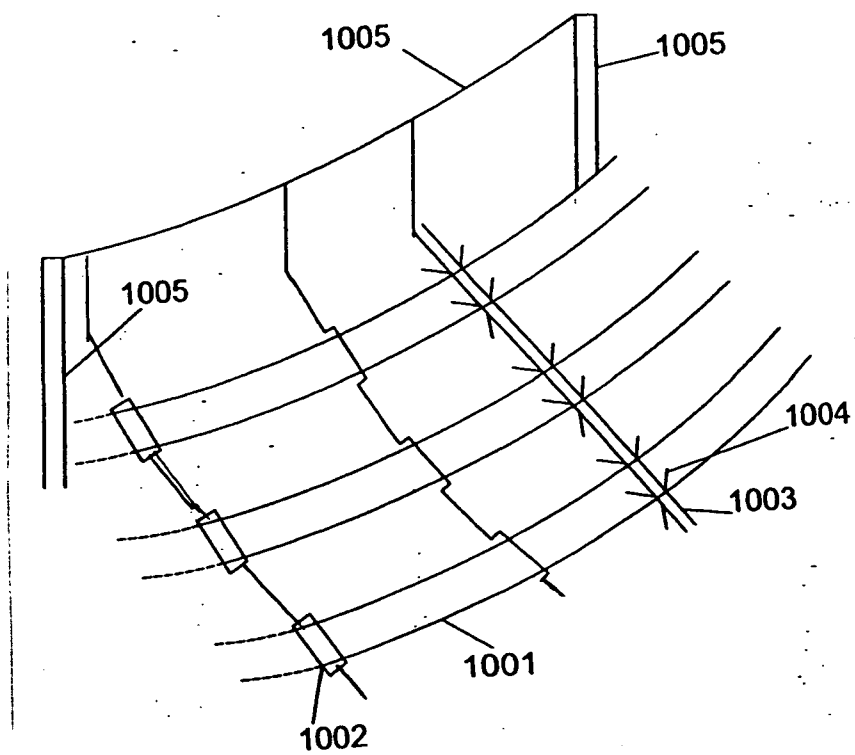


FIGURE - 10

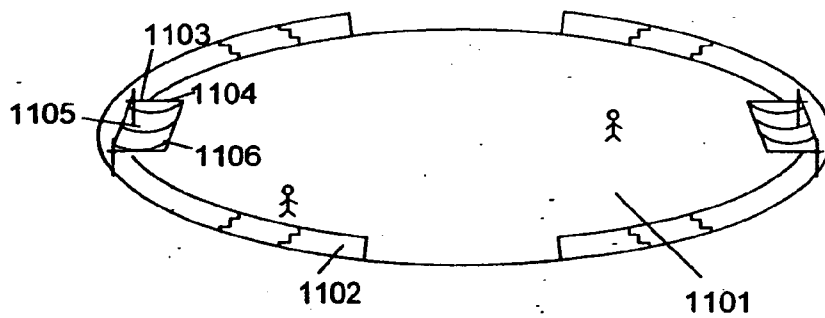
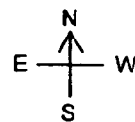


FIGURE -11

**DEVICE TO DEPLOY RAPIDLY AND COVER
STADIUM AND OPEN SPACE TO COLLECT
RAINFALL**

CLAIMS OF PRIORITY

[0001] This patent application claims priority from the Provisional Patent Application No. 3043/CHE/2012 filed on 25 Jul. 2012.

FIELD OF TECHNOLOGY

[0002] This disclosure relates generally to technical fields of weather protection of events in large open space involving mechanism and computer, and in one embodiment to a device to collect flash rain water by means of rapidly deployed rain collection strips driven by cables on supporting arm and tower, suitably adjusted to get profile of surface cover best suited for managing wind.

SUMMARY

[0003] A device, system, and method to protect from flash rains by covering large open area by rapid deployment of rain collection strips forming collecting surface, and prevent disruption of events and game is disclosed. In one aspect, the said device addresses the problem of sudden change in weather affecting pre planned events and games. The device enables proper utilization of stadium infrastructure especially when used by corporate executives and others who need assurance of playing condition not disrupted by rain and also need partial shading thereby allowing full utilization of stadiums when not having tournaments. People are tolerating flash rain problem as evidently seen in newspaper reports replete with games stopped and cancelled due to flash rain. An expensive full all weather stadiums is not cost effective as is evident from the low presence of such structures as present in current prior art.

[0004] In another aspect, the prior art has roof structures covering entire stadium with types that revolve to open and close which is expensive to build and the natural effect of open space is obstructed and diminished, more over the beauty of open space is obstructed by the structures meant to hold the roof. The present invention maintains the beautiful natural effect. Also present in prior art, retractable cable suspended roof for stadium as per U.S. Pat. No. 4,802,314 patent, this has problem of wind management due to large surface area. Retractable cover arranged circularly like in a umbrella as per U.S. Pat. No. 6,003,269 patent, has wind problem at height and yet to become popular. Helium filled balloon based inflatable roof as per U.S. Pat. No. 4,257,199 has wind problem at height. Prior art has devices wherein people have thought of artificial cloud seeding of game cities to dissipate potential rain clouds but this is not accurate and very expensive and high power consuming and difficult to protect target area. Prior art quoted by preliminary search authority under PCT being general state of art, are U.S. Pat. No. 4,280,306 A, FR 2891856 with film converging to central point leads to difficulty in folding and does not address wind pressure build up on being single layer and WO 8904896 relates to support structures does not address the wind problem and need for rapid deployment. The present invention over comes the problems in the prior art quoted by search authorities. The present invention is low on infrastructure cost and low on power consumption compared to prior art while still giving the required protection in most economical manner. More

importantly it address the need to manage wind by means of best profile of surface for air flow and wind control cable by balancing forces through drives controlled by computer. Present device for which protection is sought and the method of solving problems involved is completely different from prior art with importance to profile generation suitable for wind flow, with rapid cable connection and cable laying and cable movement on top of players without disrupting or stopping game, wind control cable managed by computer, mobility of device for required critical place and critical time, cassette like box for storing collector strips and cables thereby allowing portability.

[0005] The rapid deployment and getting right surface contour pattern configuration allowing free flow of wind enabling wind management for the large required area is the major step in working of the device. The use of aerodynamic control of wind with split arrangement of rain collection strips is the most essential ingredient for rapid deployment and retraction and for the proper working of the device. The balancing of wind pressure one by means of rotation of supporting towers for changing the angle of surface to suit wind direction and one by applying balancing force by changing the angle of wind control cables and changing applied force for the same. The presence of drainage collector allows contour surface required but still ability to collect and drain water, with drain unit being of rubber material which is essential for safety, and using water filled rubber bags for counter weight, along with safety cable to hold the unit. Set of rotating cantilever arm with tower fixed on spectator gallery suspend a supporting arm using which smaller rain collection strips are suspended to cover area near borders and curved areas where required. A rotating cantilever arm with suspended gripping tool is used to correct any problems and attaching any improperly connected wind control cable.

[0006] The plurality of camera capture profile of rain collector surface as upper layer has contrasting color and pattern compared to lower layer which helps detection of wind direction and effect and to enable proper profile by lowering one support arm and raising another support arm and by rotating the towers on the rail where needed which is predicted by the help of operator who sees image on monitor screen and moves cursor pointer from his experience and taking into account changes in wind direction as it occurs.

[0007] The scope of the Invention extends to protecting rain sensitive crops at critical periods such as flowering and fruit formation, open grain storage at harvest time, timber yard, and other open spaces. History is replete with cancelled matches, stopped games and postponed concerts and musical events and lost elections for political parties due to inclement weather. In addition when device is used for partial shading people with sun allergy will benefit from the device and women avoiding sun to protect their fair white complexion can participate in sports.

[0008] The device, systems, and methods disclosed herein may be implemented in any means for achieving various aspects, and may be executed in a form of a machine-readable medium embodying a set of instructions that, when executed by a machine, cause the machine to perform any of the operations disclosed herein. Other features will be apparent from the accompanying drawings and from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Example embodiments are illustrated by way of example and not limitation, in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

[0010] FIG. 1 is a system view of entire device with rain collector strips in North South direction, according to one embodiment.

[0011] FIG. 2 is system view of entire device with rain collector strips in east west direction, according to one embodiment.

[0012] FIG. 3 is a system view of entire device with towers being mounted on base with wheels and track, according to one embodiment.

[0013] FIG. 4 is a section view of one layer only of rain collector strip, for sake of clarity, with drainage unit and wind control cable according to one embodiment.

[0014] FIG. 5 is a section view of cable connector and guide arm with cable connectors being engaged, according to one embodiment.

[0015] FIG. 6 is a section view of the rain water drainage unit, according to one embodiment.

[0016] FIG. 7 is a section view cable coupler with connector, according to one embodiment.

[0017] FIG. 8 is a system view of a multiple cable spool drive, according to one embodiment.

[0018] FIG. 9 is a system view cantilever arm with gripping tool to enable cable connections and correct roll over and other problems, according to one embodiment.

[0019] FIG. 10 is a view of spacer and roll preventor and space control arm, according to one embodiment.

[0020] FIG. 11 is a system view rotating cantilever arm to suspend supporting arm for protecting near border area which are curved, according to one embodiment.

[0021] Other features of the present embodiments will be apparent from the accompanying drawings and from the detailed description that follows.

DETAILED DESCRIPTION

[0022] A device, system, and method to protect from flash rains, by covering large open area by rapid deployment of rain collection strips forming collecting surface and prevent disruption of event and game is disclosed. Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments.

[0023] FIG. 1 is a system view of entire device with rain collector strips in north south direction, according to one embodiment. Particularly, FIG. 1 illustrates a stadium 101, spectator gallery 102, tower to support rain collector strips 103, rain collector strips in north south direction 104, cable holding the rain collector strips 105, according to one embodiment.

[0024] In example embodiment, the north south direction is chosen depending on the past data of wind direction and current trend so as to get the appropriate profile surface to manage the wind.

[0025] FIG. 2 is a system view of entire device with rain collector strips in east west direction, according to one embodiment. Particularly, FIG. 2 illustrates a stadium 201, spectator gallery 202, tower to support rain collector strips

203, rain collector strips in east west direction 204, cable holding the rain collector strips 205, according to one embodiment.

[0026] In example embodiment, the east west direction is chosen depending on the past data of wind direction and current trend so as to get the appropriate profile surface to manage the wind.

[0027] FIG. 3 is a system view of entire device with towers being movable with wheels and track, according to one embodiment. Particularly FIG. 3 illustrates the stadium 301, spectator gallery 302, towers of rain collector strips with wheels 303, rain collector strips 304, cable holding the rain collecting strips 305, tracks on which the towers are moved 306.

[0028] In example embodiment, the towers are rotated by 90 degrees or a part of it, to convert one of east west facing contours to north south facing contours depending on the wind direction so as to get the appropriate profile, wherein the wheels of tower move on one of a pre laid track and where tracks are absent the wheels have rubber tires that move on plain ground.

[0029] FIG. 4 is a section view of one layer only of rain collector strip, for sake of clarity, with drainage unit according to one embodiment. Particularly, FIG. 4 illustrates a rain collector strip 401, tower 402, lower cable support arm for the rain collecting strip 403, side supporting cable 404, drainage unit 405, drainage channel on ground 406, drive for pulling up support cable 407, upper cable support arm 408 for wind control cables, with wind control cable 409, according to one embodiment.

[0030] In example embodiment, the rain collector strip is suspended by lower support arm one of which is raised above the height of the other opposite side lower support arm to give the required profile that allows wind to flow freely.

[0031] FIG. 5 is a section view of cable connector and guide arm with cable connectors being engaged, according to one embodiment. Particularly, FIG. 5 illustrates the tower 501, cable connector and guide arm with cable coupler 502, cable that provide drive for the rain collector strips 503, cable connector arm with cable coupler for cable coming from spool 504, upper support arm 505 and wherein cables are driven by electric motor, according to one embodiment.

[0032] In example embodiment, support arm being a rod made of plastic material with upper support arm holds wind control cables through one of pulleys and one of rollers while lower side support arm supports rain collection strips and wherein the cable connector and guide arm allow correct laying of cables over the towers to enable smooth deployment of rain collector strips even as the game is in progress without disruption which is a very important aspect of the device.

[0033] FIG. 6 is a section view of the drainage unit, according to one embodiment. Particularly, FIG. 6 illustrates the drainage unit 601, frame carriage of the drainage unit with rollers 602, drainage pipe 603, rain collection strip 604, and cable for required placement of drainage unit 605 according to one embodiment.

[0034] In example embodiment, the drainage unit allows rain water to be carried away through one of the drainage channel on ground and one of separate collector pipe so that the ground is not affected by moisture from the rain the drainage unit also carries a wind control cable and is itself controlled by a drive cable, the drainage unit is carried on the lower side support arm and the rain collector strip along with wind control cables pass through the frame during deploy-

ment and wherein lower and upper support arm has strong cables attached which are anchored to ground to withstand wind pressure.

[0035] FIG. 7 is a section view cable coupler with connector on cable connector and guide arm, according to one embodiment. Particularly, FIG. 7 illustrates the cable connector and guide arm for drive cables of the rain collector strips 701, cable to drive the rain collector strips 702, coupler with male and female sockets 703, cable connector and guide arm 704 for cables from spools which are driven by electric motor, cable going to spool 705, spool being 706, according to one embodiment.

[0036] In example embodiment, the connector comprising of male and female sockets enable correct and fast laying out of cables and connecting to the correct spools which are in turn controlled by the computer which give actuate and release signal to solenoid that actuated and release the clutch and brake units of the cable spool.

[0037] FIG. 8 is a system view of a multiple cable spool drive, according to one embodiment. Particularly, FIG. 12 illustrates the drive motor 801 for forward drive, shaft 802, belt drive 803, clutch unit 804 for forward drive, brake and hold unit 805, drive cable 806 on spool 807, brake control cable 808 and clutch control cable 809 both operated by solenoids controlled by computer, clutch for reverse drive 810, drive motor 811 for reverse drive, according to one embodiment.

[0038] The actuate and release timing of the clutch and brake is calculated by the computer based on the initial deployment needed and forces needed to counter and balance wind effect. The cable spool at one end winds up while the cable spool at other end unwinds.

[0039] FIG. 9 is a system view cantilever arm with gripping tool to enable cable connections and correct roll over and other problems, according to one embodiment. FIG. 9 illustrates the rain collection strip 901, tower 902, rotating base 903, cantilever arm 904, cable hold and pulley 905, cable 906 with gripping tool 907, according to one embodiment.

[0040] The gripping tool is used to make connection of wind control cables not properly connected by connector arm and correct any other problem.

[0041] FIG. 10 is a view of spacer and roll preventor and space control arm, according to one embodiment. Particularly, FIG. 9 illustrates the rain collection strips 1001, spacer frame through which rain collector strip passes 1002 each of which is connected to next neighboring frame by one of rigid plastic rod and one of flexible cable string, space control arm 1003, strip holding tooth rods to control spacing 1004, tower 1005 and side supporting cable 1006, according to one embodiment.

[0042] The spacer and roll preventor is carried on the lower support arm before deployment and is carried along as rain collector strips are deployed.

[0043] FIG. 11 is a system view of rotating cantilever arm to suspend supporting arm holding rain collection strips for protecting near curved border area, according to one embodiment. FIG. 11 illustrates stadium 1101, spectator gallery 1102, tower 1103, cantilever arm 1104, rain collector strip 1105, supporting arm 1106 according to one embodiment, according to one embodiment.

[0044] Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be

made to these embodiments without departing from the broader spirit and scope of the various embodiments.

[0045] In addition, it will be appreciated that the various operations, processes, and methods disclosed herein may be embodied in a machine-readable medium and/or a machine accessible medium compatible with a data processing system (e.g., a computer system), and may be performed in any order (e.g., including using means for achieving the various operations). Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

I claim:

1. A device to deploy rapidly and cover open space and stadium to collect flash rainfall thereby protect the event from disruption, protect people and objects, and having ability to manage wind with surface profile control and drainage of collected water from resulting surface profile, said device being portable, with said device comprising of;

- a) plurality of rain collection strips, drive for rain collection strips and cables, support cable, tower mounted on wheel, wind control cables, support arm with strip guide, cable connector and guide arm, drainage unit;
- b) plurality of camera on gimbal, computer and display monitor console for manual support, wind sensors and cable tension sensors;
- c) plurality of cantilever arm with gripping tool, cantilever arm based support at border area.

2. A device as claimed in claim 1;

Wherein the rain collection strip being at least one of plastic film, and plastic film reinforced with fiber, and fabric with nylon chords to withstand force and one of fabric cloth, and rubber sheet, with a strong cable at the border to guide water flow and give shape and wherein collection strip is one with strip having sleeve at both edges with cable passing through allowing free movement of strip on cable, and wherein the film having ultra violet absorption chemicals so device can be used for shading and wherein rain collection strip being rolled on spool in holding box having cleaning brush while winding in, with box having spool drive motor for retraction and wherein the rain collection strip is one of transparent and one of opaque and one of combination of transparent and opaque to get shading and required light needed and wherein the rain collection strip being arranged in more than one layer to allow free flow of air for aerodynamic management of wind, being one of double layer with lower layer having extensions with over lap to cover completely the gaps in the upper layer and to get effective full coverage, and one of three layers used if very good prevention of rain water entry is needed.

3. A device as claimed in claim 1:

Wherein the support tower to hold cable support arm, support cables and wind control cables is mounted on base with wheels with electric drive motor and gear, moving on one of rail track having metallic track confining wheel and moving on one of leveled ground with rubber tires where rail tracks are not used, and with tower having balancing cables attached to ground by anchor to prevent swaying in wind and wherein tower being foldable and one having telescoping tubing, to allow transport and avoid obstruction to view when not in use.

4. A device as claimed in claim 1:

Wherein the border area which is curved is protected from rain using separate rain collection surface formed using

pair of rotating cantilever which suspend support arms on which the rain collection strips are supported.

5. A device as claimed in claim 1:

Wherein the cable support arm comprising of upper cable support arm for wind control cables and lower cable support arm for rain collection strips, having rollers to suspend rain collection strips, which is raised up on one side and lowered on other side to get a proper curved profile for best flow of wind, and wherein cables go to drive units placed on roof of spectator gallery without obstructing game and view.

6. A device as claimed in claim 1;

Wherein the cable connecting and guide arm with coupler carries the cables from spool at opposite side over to top of tower and along to the other side with the help of side support cable and enable drive cable connection to be made rapidly to rain collector strip without stopping and interrupting the event or game.

7. A device as claimed in claim 1;

Wherein wind control cables supported on upper support arm, attached from top and from bottom of the rain collection strip, help in getting required surface profile and wherein cables are attached to cable attachment points on the rain collection strip and wherein cable connector arm meant for guiding connection of wind control cables enables proper and quick connection and with wind control cable being provided with damper one of spring type and one of cylinder with piston having perforations and having damping fluid, and where in water filled rubber bags are used to provide weight to the rain collection strip where needed for balancing forces from wind.

8. A device as claimed in claim 1;

Wherein the drive force for cable is provided by at least one of electric motor on ground, being one of alternating current, one of direct current and one of stepper motor, with driving shaft having spools for cable controlled by clutch and brake to select either to wind or unwind cable as decided by the computer with actuation through solenoid and wherein drive cables with spool are housed in cassette like box for easy storage and transport.

9. A device as claimed in claim 1:

Wherein drainage unit being made of frame with rubber rollers to grip the rain collection strip with one edge raised and other edge lowered to allow water to drain to collector tray having flat type flexible pipe attached to discharge water to one of ground channel and to one of collecting pipe to take it outside the protected area and with the collector tray being one of rubber material for safety reason and wherein the drainage unit is carried on the lower support arm before deployment and deployed along with rain collection strips which passes through the frame of the drainage unit during deployment.

10. A device as claimed in claim 1:

Wherein drainage unit is avoided to accommodate more wind control cables in demanding windy condition, a separate drainage water collector strip is used which is

placed perpendicular to direction of rain collection strips, being suspended from side support cable, and wherein separate drainage water collector strip drains the water to one side of the protected area by forming a sloping wedge like profile.

11. A device as claimed in claim 1;

Wherein the Camera unit mounted on gimbal is oriented to fix reference coordinated and forming grid map, captures the cover surface contour image and profile and movement of rain collector strips based on wind, and provide image on monitor to enable control of wind control cables by computer and with operator assistance and wherein image of rain collector strips enable correction of problem with the help of cantilever arm with gripping tool from top and wherein the camera covers a selected sector of the area involved.

12. A device as claimed in claim 1;

Wherein the computer using program instructions, analyses image from camera to detect wind effect and calculate counter force required from wind control cable, controls image display on monitor with console and joy stick for manual support by moving cursor pointer for enabling control of wind control cables and wherein the computer controls drive cables by controlling the winding and unwinding of drive cables and wind control cables by providing actuate and release signal to solenoid which actuates and releases clutch and brake of spool with proper timing which enables in getting required profile of rain collection strip, and wherein computer provides drive pulse signal to stepper motors, and take data from wind and cable tension sensors and gives correction signal to wind control cable drive and wherein interface with computer is by one of wire and one of wireless radio control, and wherein computer records wind direction from wind vane and wind sensors and gets likely wind direction by prediction based on past wind data for the region

13. A device as claimed in claim 1;

Wherein tear and leakage water collecting unit is formed by one of rotating cantilever mounted on a pole with collector tray and one of collection strip moved on cable suspended from side support cable, moved to required leaking position, under the rain collecting surface and thereby give a perfect protection by prevention of water entry from rain.

14. A device as claimed in claim 1:

Wherein the said device is used for protecting people in large political and religious rallies and meeting, large scale food storage area, open air theatres, rain sensitive crops like one of grapes for disease management in critical flowering and fruit set stage, musical concerts, and emergency relief accommodations, cotton storage yards, also for protection from hail for crops, and for protection from snow fall and wherein the said device is used to provide shade from blazing sunshine.

* * * * *