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PATENTS ACT, 1978

CERTIFICATE

In accordance with section 44 (1) of the Patents Act, No. 57 of 1978, it is hereby certified that:

**XINJIANG INSTITUTE OF ECOLOGY AND GEOGRAPHY;
CHINESE ACADEMY OF SCIENCES**

Has been granted a patent in respect of an invention described and claimed in complete specification deposited at the Patent Office under the number

2022/02945

A copy of the complete specification is annexed, together with the relevant Form P2.

In testimony thereof, the seal of the Patent Office has been affixed at Pretoria with effect from the **29th** day of **June 2022**




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FORM P2

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72	Full name(s) of inventor(s): (1) WANG Yongdong; (2) YOU Yuan; (3) ZHOU Na					
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COMPLETE SPECIFICATION
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FULL NAME(S) OF APPLICANT(S)

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TITLE OF INVENTION

54	Construction Method of a Comprehensive Protection System for Urban Desertification Control in Sand Areas
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Construction Method of a Comprehensive Protection System for Urban Desertification Control in Sand Areas

TECHNICAL FIELD

The invention relates to the technical field of shelter forest construction, and in particular to a construction method of a comprehensive protection system for urban desertification control in sand areas.

BACKGROUND

The main body of shelter forest construction is to reasonably increase the vegetation coverage, improve the structure of terrestrial ecosystem, and restore and improve its ecological functions. The construction of comprehensive protection system around the city circle in sandy areas can not only greatly expand the ecological space of urban environmental capacity, but also improve the contradiction between the fragility of ecological environment and the quality of resources and environment in regional coordinated development.

The protection system of the city circle in the sand area refers to the combination of various protection technologies aimed at protecting the urban safety and sustainable and efficient development of the residents, which are formed by ecological problems such as strong sandstorm activities, frequent sandstorms and so on, resulting in fragile living environment and slow social and economic development, and then threatening the production and life of urban and rural residents. Therefore, it is not only the core content of implementing ecological protection in the city circle of sand area, but also an important measure to smoothly promote regional social progress and resist natural disasters to protect resources, building facilities, agriculture and animal husbandry production, living environment and so on in ecologically fragile areas from or reduce the threat of disasters through the integration of key technologies such as wind-proof and sand-fixing forest system construction, economic forest construction and mechanical sand prevention technology.

SUMMARY

The purpose of the invention is to provide a method for constructing a comprehensive protection system for urban desertification control in sand areas. This

method can not only protect the resources, building facilities, agriculture and animal husbandry production, living environment, etc. in ecologically fragile areas from or reduce the threat of disasters, but also make the urban social, economic and ecological sustainable development.

The technical scheme of the invention is as follows: a construction of a comprehensive protection system for urban sand control and desertification control in the sand area, which takes the cities in the sand area as the center, sequentially constructs an urban sand cleaning and sand fixation area, an eco-economic plant barrier belt, a mechanical sand blocking and sand fixation protection belt, an artificial ecological restoration belt and a peripheral enclosure protection zone from inside to outside.

The cities in the sand area refer to the cities that have been invaded by wind and sand for a long time, which have caused the poor living environment and seriously affected the ecological security, and also refer to the cities originally built around the desert.

Further, the urban sand cleaning and sand fixation area takes the cities in the sand area as the center, and removes or fixes the quicksand which has entered the streets and buildings in the main urban area due to wind and sand intrusion through cleaning, hardening or vegetation covering in order to beautify the urban environment and promote the cleanliness of the city.

Furthermore, the eco-economic plant barrier zone is an eco-economic protection zone of 2000-3000m, which is built on the outskirts of cities in the sand area.

Further, the eco-economic protection belt includes a sand-blocking and wind-proof basic trunk forest belt and an eco-economic forest.

Furthermore, the sand-blocking and windproof basic dry forest has a bandwidth of 200 meters, and is established by combining any one or two of trees, shrubs and grasses.

As the last barrier to block the invasion of quicksand into cities, the main forest belt of sand-proof and wind-proof can screen suitable native shrub species and suitable grass varieties, and construct sand-proof and wind-proof forest with less

water consumption and combination of shrub and grass, which can not only block the invasion of peripheral quicksand, but also play a role of strong wind diversion.

Eco-forest uses economic tree species to build shelterbelts, planting eco-economic plants in shelterbelts, developing ecological industries and planting vegetables, etc., and establishing urban non-staple food bases; It is composed of native economic forest species or suitable economic forest species introduced through screening, and the planting density should not be too high, which not only expands urban non-staple food, generates economic benefits, but also plays a role in reducing wind and sand hazards.

Furthermore, the mechanical sand-blocking and sand-fixing protective belt is 500-1000 m wide and is constructed by combining mechanical sand-fixing squares with artificial vegetation planting. The purpose is to block and fix the mobile sand dunes in this area.

Localized, environment-friendly biological materials such as crop straws and plant branches can be used. According to the site type division and the damage situation of wind and sand, sand fixation measures can be omitted in the area between ridges (hills) of sand ridges, and small squares can be set up in mobile sand dunes and sand ridges. The arrangement of small squares can adopt different specifications according to different parts of sand dunes (ridges) to form multi-specification and multi-type mechanical sand fixing squares such as "1×1, 1×2, 2×2".

Furthermore, an artificial ecological restoration belt is constructed around the mechanical sand-fixing grid by using local predicted or irrigation conditions, and the artificial ecological restoration bandwidth is 1000-3000 m, which is constructed by cutting native species and/or sowing grass species.

Furthermore, the peripheral enclosure protection area is 5,000 m wide, and an enclosure protection grazing prohibition area is set up. Take the way of banning, win the rest of land fertility and achieve the stability of ecosystem.

Compared with the prior art, the invention has the following beneficial effects:

According to the present situation and environmental conditions of wind and sand hazards in cities in sand areas, and following the protection design principle of

"defending against hazards and adapting to local conditions", the invention forms a "five in one" comprehensive protection system of city circle with complete structure, reasonable layout and proper measures, which aims at overall planning, zoning control, radical treatment of sand hazards, protection of cities and sustainable development. The method of the invention has been planned in Nouakchott and Chami, the capital of Mauritania.

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BRIEF DESCRIPTION OF THE FIGURES

Fig. 1 shows the layout of comprehensive protection system in Nouakchott, Mauritania.

Fig. 2 is the design of the existing protection system in Chami New Town;

Fig. 3 is the general layout of the comprehensive protection system of Chami New Town;

Fig. 4 is the layout of the landscape green belt for wind and sand resistance in Chami New Town.

Fig. 5 is the structural layout of the mechanical sand-blocking and sand-guiding project in Chami New Town.

DESCRIPTION OF THE INVENTION

Now, various exemplary embodiments of the present invention will be described in detail. This detailed description should not be considered as a limitation of the present invention, but should be understood as a more detailed description of some aspects, characteristics and embodiments of the present invention.

It should be understood that the terms used in this invention are only for describing specific embodiments, and are not used to limit the invention. In addition, for the numerical range in the present invention, it should be understood that each intermediate value between the upper limit and the lower limit of the range is also specifically disclosed. Any stated value or intermediate value within the stated range and any other stated value or every smaller range between intermediate values within the stated range are also included in the present invention. The upper and lower limits of these smaller ranges can be independently included or excluded from the range.

Unless otherwise specified, all technical and scientific terms used herein have the same meaning as commonly understood by the ordinary technicians in the field of this invention. Although the present invention only describes the preferred methods and materials, any methods and materials similar or equivalent to those described herein can also be used in the practice or testing of the present invention. All documents mentioned in this specification are incorporated by reference to disclose and describe the methods and/or materials related to the documents. In case of conflict with any incorporated documents, the contents of this specification shall prevail.

Without departing from the scope or spirit of the present invention, it is obvious to those skilled in the art that many modifications and changes can be made to the specific embodiments of the present invention. Other embodiments obtained from the description of the present invention will be obvious to the skilled person. The description and example of that present invention are exemplary only.

The words "including", "including", "having" and "containing" used in this paper are all open terms, that is, they mean including but not limited to.

Example 1

Nouakchott, the capital of Mauritania, is a coastal city of tropical desert, with the Atlantic Ocean in the southwest and endless deserts in the north, south and east. Nouakchott used to be the edge of the Sahel region, but now it is located in a sea of sand. The surrounding city is densely covered with sand dunes, burying the houses in the suburbs and constantly moving to the urban area. In recent years, the sandstorm has been attacking the city continuously, and the streets and alleys are filled with thick

sand layers, covering the road surface.

Nouakchott is surrounded by desert on the north, east and south sides. The traffic and building around the city are seriously damaged by wind and sand, and the ecological security of the capital is facing great challenges. In order to prevent and control the wind and sand hazards and improve the ecological environment and living conditions of the capital, Mauritania has carried out a series of protection and control measures, such as the restoration and promotion plan of the Green Belt Project and Nouakchott Green Belt Project. The main purpose is to protect Nouakchott from desertification on the one hand, and provide employment opportunities for the poorest farmers who have just arrived in Nouakchott and the victims of rural-urban migration on the other.

Although sand fixation and vegetation restoration measures have been taken around the capital, firstly, because the setting of the protection circle did not form a closed system, the wind-blown sand flow and sand dunes outside the system still flowed to the urban area; secondly, a large number of mobile sand dunes remained between the protection circle and the city, which continued to endanger the security of the capital and made quicksand enter the urban area, causing great harm to the buildings and roads of the city.

Therefore, the application and implementation of the invention will form a comprehensive protection project of the capital, which integrates the prevention and control of wind and sand disasters, comprehensive protection of cities, development of suburban sand industry and beautification of urban environment, through the repair, improvement and planning and construction of existing protection projects. Completely change the landscape and living conditions of the capital and the production and life style of suburban herdsmen, and ensure the ecological security and sustainable development of the capital. The specific steps are as follows.

A construction method of a comprehensive protection system for a city circle in a sand area, which is composed of (1) a city sand clearing and fixing area, (2) an eco-economic plant barrier zone, (3) a mechanical sand blocking and fixing protection zone, (4) an ecological artificial restoration zone and (5) a peripheral enclosure and

protection zone from inside to outside.

A, urban sand cleaning and sand fixation area: clean up and harden or cover the quicksand with vegetation in the urban area, eliminate the quicksand entering the urban area, carry out environmental improvement and beautify the urban environment.

B, Eco-economic barrier zone: According to the current situation, only relying on natural rainfall to plant trees and restore vegetation in suburban areas, it is impossible to comprehensively prevent and control the harm of wind and sand to the capital, completely change the ecological environment and living conditions of the capital, and finally ensure the ecological security of the capital.) Establish an eco-economic barrier with a width of 2000-3000m. The ecological barrier consists of sand-blocking and wind-blocking trunk forest belt (as the last barrier to stop the invasion of quicksand, a 200 m wide wind-blocking and sand-blocking trunk forest belt is built by combining arbor, shrub and grass) and eco-economic forest (building a shelter forest net with tall trees, planting eco-economic plants in the shelter forest net to develop eco-industry and planting vegetables to build a non-staple food base in the capital). Through water diversion irrigation and the establishment of eco-economic protection system, the mobile desert in urban suburbs is fixed, grazing activities in urban suburbs are prohibited, the living conditions of people in this area are improved, the production and lifestyle of people in this area are changed, and they are turned into eco-industrial workers. The construction of this area can not only completely change the ecological environment of the capital, but also become the vegetable and non-staple food base of the capital and provide a large number of jobs.

C, mechanical sand-blocking and sand-fixing protection belt: outside the eco-economic zone, a comprehensive sand-fixing belt with a width of 1,000 m is established by combining mechanical sand-fixing squares with artificial planting vegetation, and the mobile sand dunes are blocked and fixed in this area.

D, artificial ecological restoration zone: an ecological restoration zone of 3000 m is established by planting vegetation outside the mechanical sand-blocking and sand-fixing protection zone.

E, peripheral enclosure protection zone: enclosure protection and grazing prohibition zone is set up within 5,000 m outside the ecological restoration zone around the capital.

See Figure 1 for the layout of comprehensive protection system in Nouakchott, Mauritania.

Example 2

Chami New Town is located in the extreme arid area in the southwest of Sahara region, where rainfall is scarce, evaporation is intense, air is dry, surface vegetation is scarce, and wind-sand hazards are serious. According to the local wind direction and the main hazards of wind-sand flow, and the need of urban wind-sand disaster protection, the comprehensive protection system of Chami New Town is designed as one zone and three zones, namely, windbreak and greening protection zone, artificial restoration plant sand fixation zone, mechanical sand-blocking and sand-guiding engineering zone, and enclosure and protection ecological restoration zone. The general layout of the existing protection system and comprehensive protection system is shown in Figure 2. The general layout of the comprehensive protection system in Chami New Town is shown in Figure 3.

(1) Wind-proof and sand-blocking landscape green belt

Firstly, a landscape green belt with wind and sand resistance is built around the city by water-saving irrigation. The overall structure layout of the green belt is shown in Figure 4.

The width of the windbreak landscape green belt is 30m, which consists of three parts. The landscape green belt near the inner side of the city can choose ornamental fruit trees with drought tolerance, tall trees in the middle to build windbreak belts, and excellent sand-fixing plants with fast growth and sand burial tolerance in the outer side to form the last sand-blocking measure around the city.

(2) Artificial restoration of plant sand-fixing belt

The artificial sand-fixing belt is set up outside the windbreak landscape green belt by means of artificial assistance. Its main purpose is to reduce wind speed, prevent wind erosion, reduce sand-carrying capacity of wind-blown sand flow, fix

local quicksand and prevent wind-blown sand hazards. The plant sand-fixing belt can be widened (500 m wide) in the north, northeast and windy direction of proprietors, reduced (150 m wide) in the weak wind side of the west, and cancelled in the downwind side of the south. In the construction of the plant sand-fixing belt, the way of planting seedlings for afforestation can be adopted, and supplementary irrigation can be given during seedling planting and young forest period to ensure the survival of seedlings, promote the early growth of seedlings and accelerate the protection benefits.

(3) Mechanical sand-blocking and sand-guiding engineering belt

Mechanical sand-blocking and sand-guiding projects are set up on the periphery of the sand-fixing belt of artificial restoration plants, the main purpose of which is to prevent the peripheral mobile sand dunes and salons from moving forward, and to divert the quicksand carried by the wind-blown sand flow. The structural layout of mechanical sand-blocking and sand-guiding project is shown in Figure 5.

Set up two high vertical sand-blocking fences 10 meters away from the west and northwest outside of the artificial restoration plant sand-fixing belt, with an interval of 10 meters between the fences.

In the north, northeast and east, two mechanical sand-blocking and sand-guiding projects are set up. In the first sand-blocking and sand-guiding project, two high vertical sand-blocking fences are set at a distance of 10 meters outside the surface of the artificially restored plant sand-fixing belt, and feather sand-discharging fences are set at a distance of 10 meters between the fences. The second mechanical sand-blocking and sand-guiding project is set 500 meters outside the first one, and the setting method is the same as that of the first one.

(4) Enclosure and protection of ecological grazing prohibition areas

The whole city is fenced with barbed wire for 5 kilometers as a grazing prohibition area around the city.

What has been described above is only the preferred embodiment of the invention, and it is not intended to limit the invention. Any modification, equivalent replacement and improvement within the spirit and principle of the invention should

be included in the scope of protection of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1. A construction method of a comprehensive protection system for urban desertification control in sand areas, which is characterized in that cities in the sand area are taken as the center, sequentially constructs an urban sand cleaning and sand fixation area, an eco-economic plant barrier belt, a mechanical sand blocking and sand fixation protection belt, an artificial ecological restoration belt and a peripheral enclosure protection zone from inside to outside.

2. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 1, which is characterized in that the urban sand cleaning and sand fixation area takes the cities in the sand area as the center, and removes or fixes the quicksand which has entered the streets and buildings in the main urban area due to wind and sand intrusion through cleaning, hardening or vegetation covering in order to beautify the urban environment and promote the cleanliness of the city.

3. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 1, which is characterized in that the eco-economic plant barrier zone is an eco-economic protection zone of 2000-3000m, which is built on the outskirts of cities in the sand area.

4. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 3, which is characterized in that the eco-economic protection belt includes a sand-blocking and wind-proof basic trunk forest belt and an eco-economic forest.

5. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 4, which is characterized in that the sand-blocking and windproof basic dry forest has a bandwidth of 200 meters, and is established by combining any one or two of trees, shrubs and grasses.

6. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 1, which is characterized in that the mechanical sand-blocking and sand-fixing protective belt is 500-1000 m wide and is constructed by combining mechanical sand-fixing squares with artificial

vegetation planting.

7. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 1, which is characterized in that the artificial ecological restoration belt is constructed around the mechanical sand-fixing grid by using local predicted or irrigation conditions, and the artificial ecological restoration bandwidth is 1000-3000 m, which is constructed by cutting native species and/or sowing grass species.

8. The construction method of a comprehensive protection system for urban desertification control in sand areas according to claim 1, which is characterized in that the peripheral enclosure protection area is 5,000 m wide, and an enclosure protection grazing prohibition area is set up.



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FIGURES

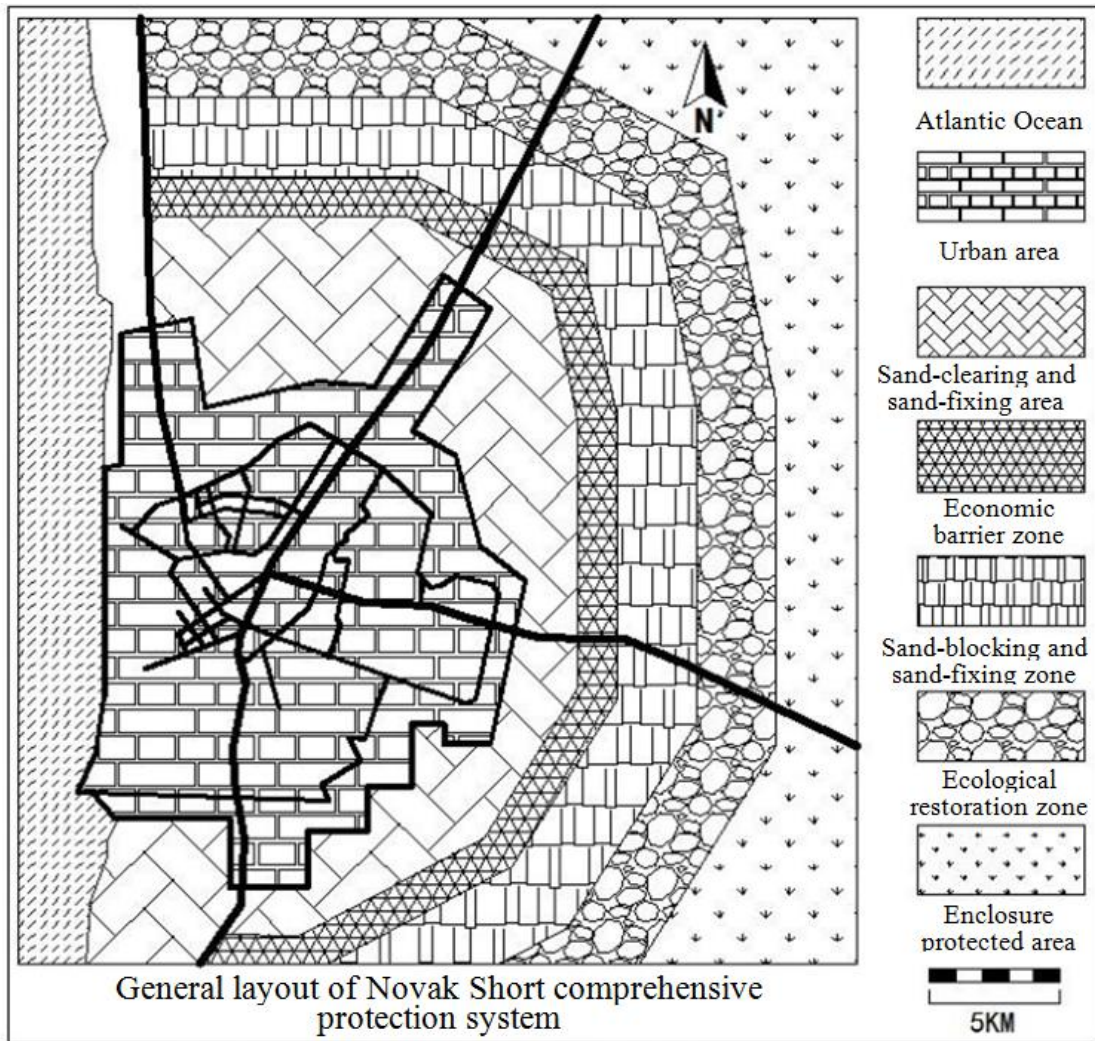


FIG. 1

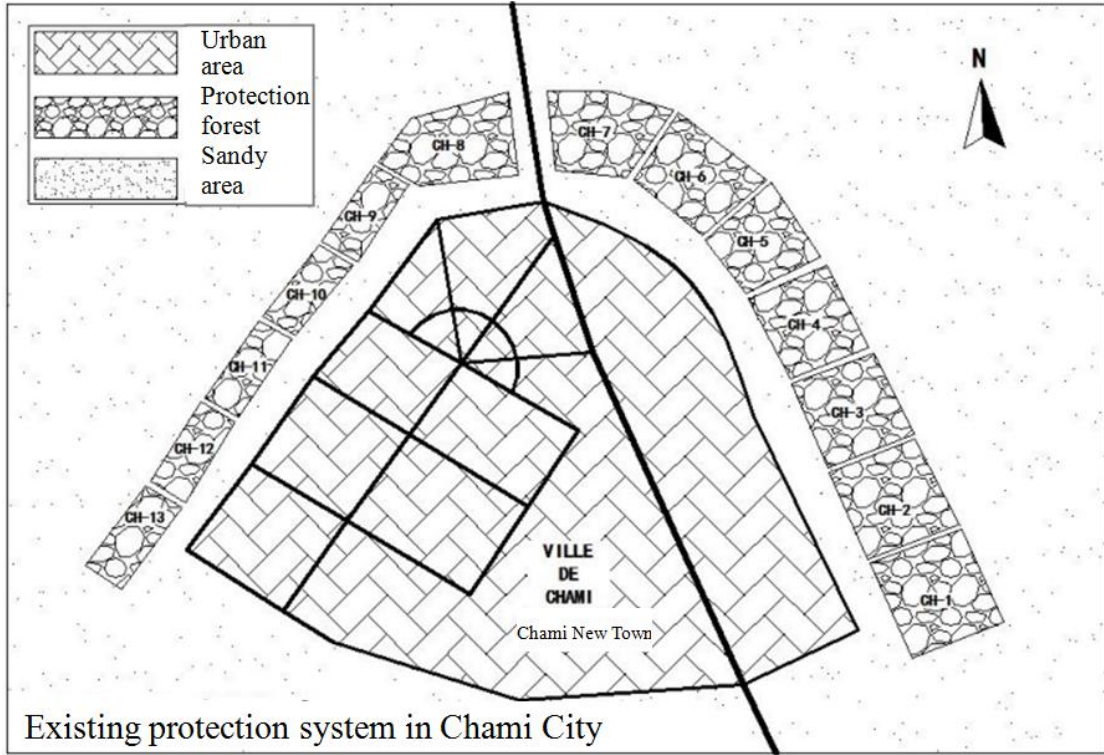


FIG. 2

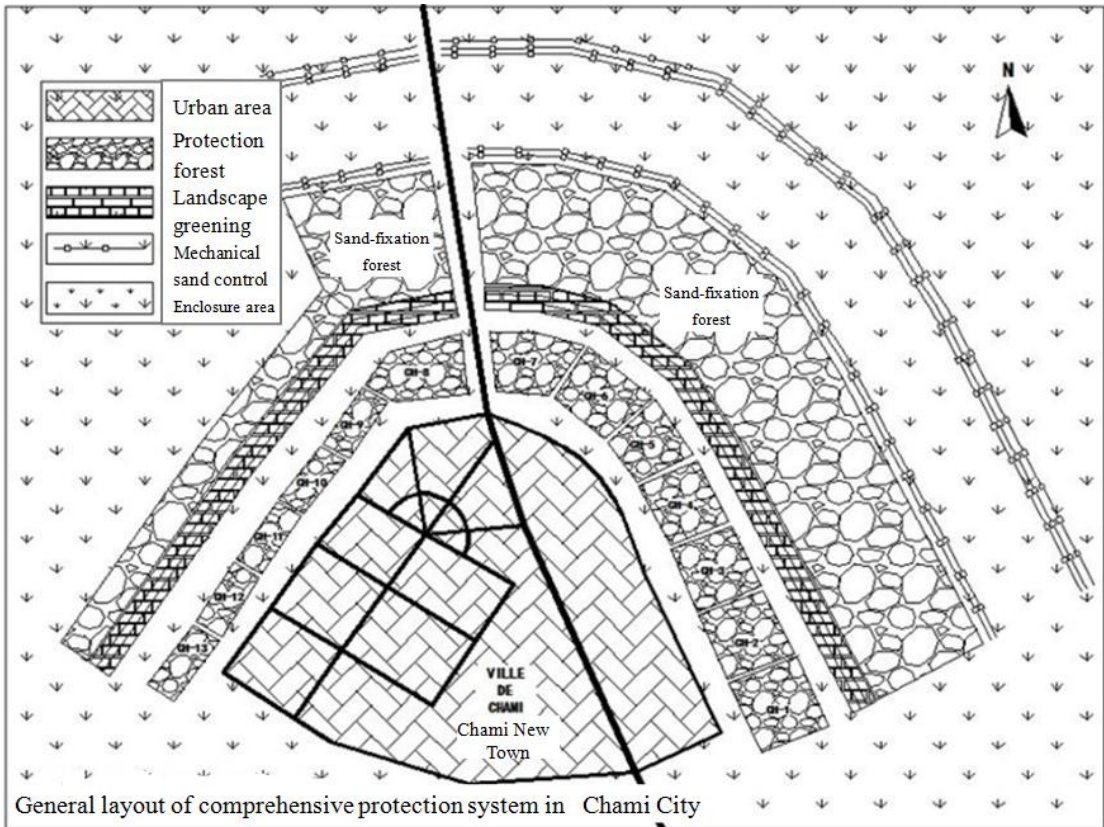


FIG. 3

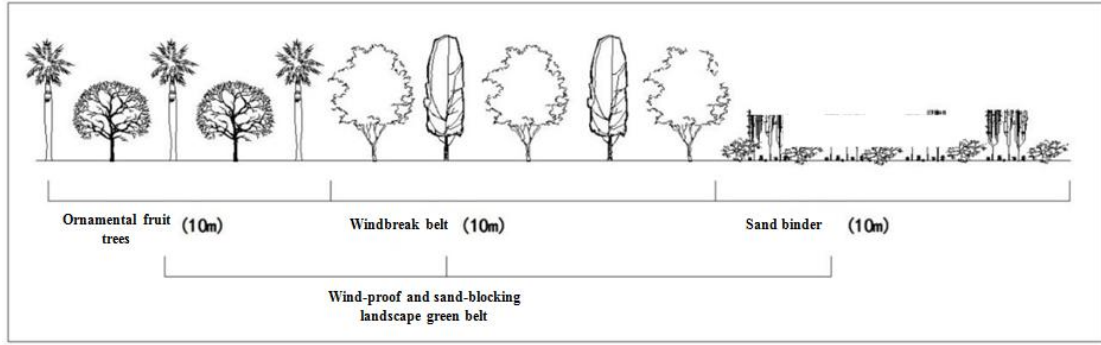


FIG. 4

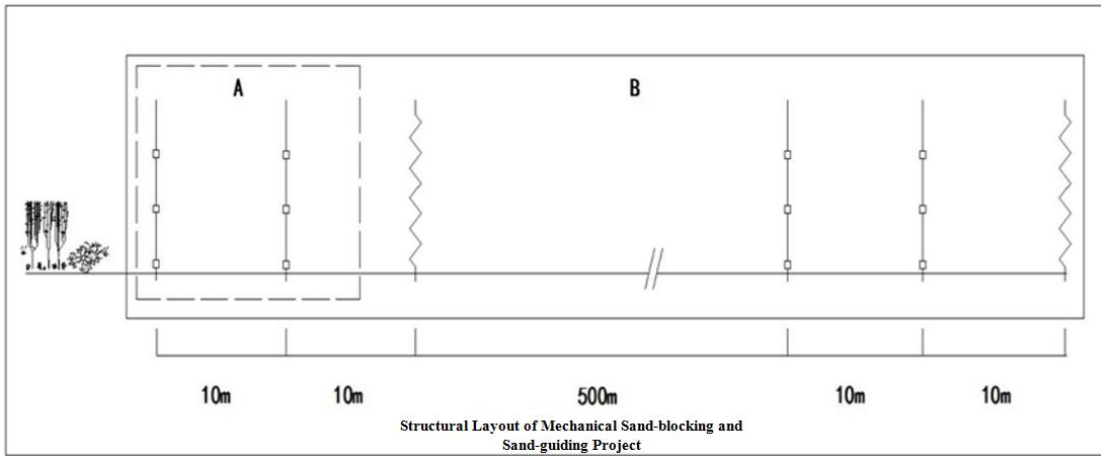


FIG. 5

ABSTRACT

The invention discloses a construction method of a comprehensive protection system for urban sand control in sand areas, which is characterized in that according to the present situation of wind and sand hazards in cities in sand areas and the climatic and environmental conditions, following the protection design principle of "defending against hazards and adapting to local conditions", taking cities as the center, from inside to outside, the urban sand-clearing and sand-fixing area, ecological and economic plant barrier zone, mechanical sand-blocking and sand-fixing zone, artificial restoration zone and peripheral enclosure protection zone are sequentially established, thus forming a reasonable layout, complete structure and proper measures. Harmonious symbiotic comprehensive protection system for desertification control in the urban circle of sandy areas can achieve the "five in one" comprehensive protection system for desertification control in the urban circle of sandy areas with overall planning, zoning control, radical cure of sand damage, protection of cities and sustainable development.