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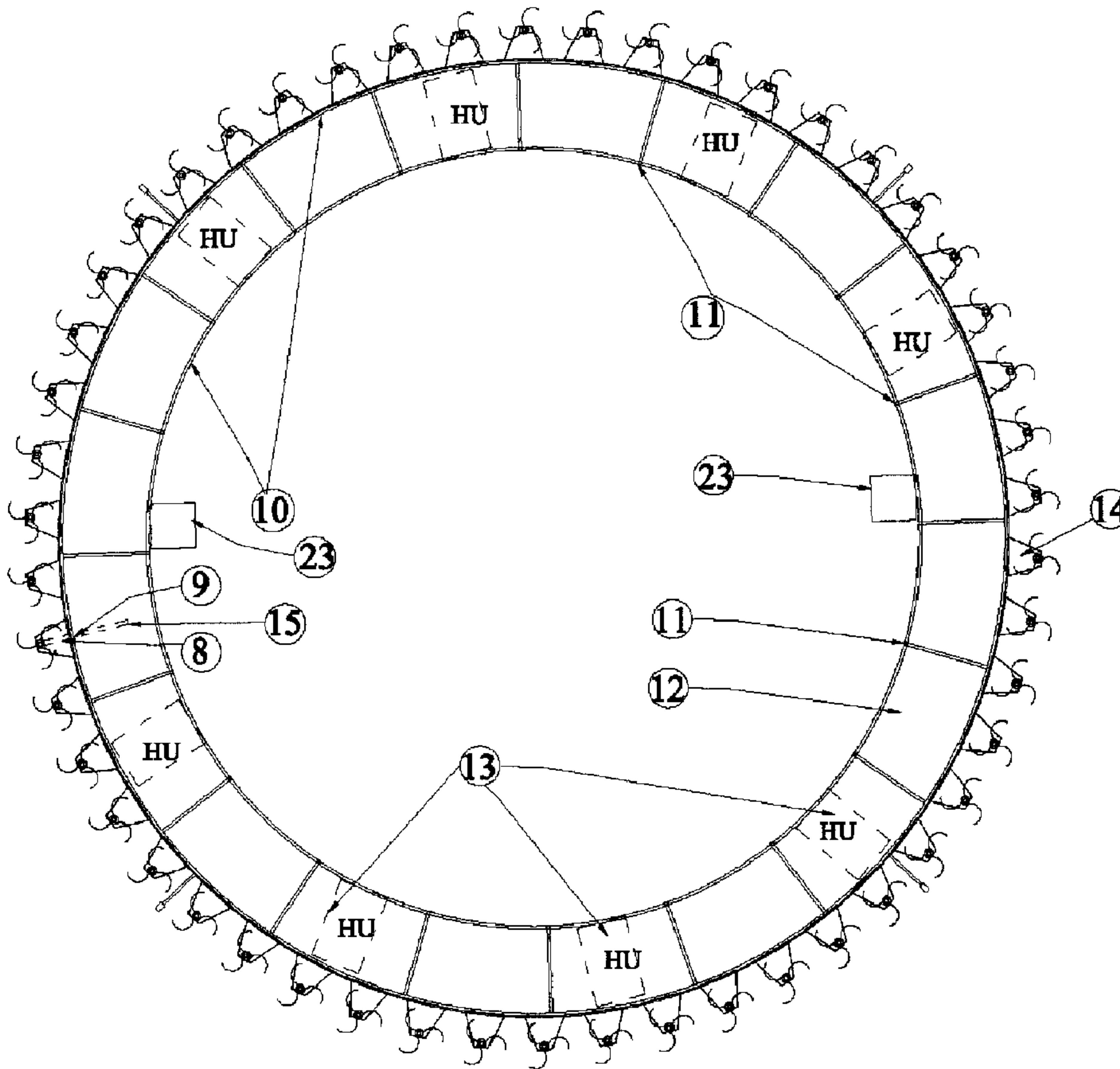
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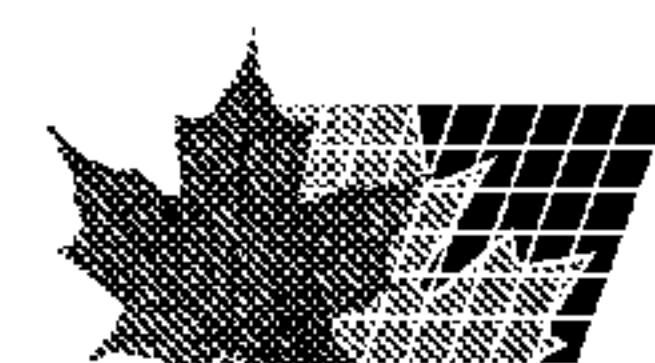
(54) **Titre : CENTRALE URBAINE DE TURBINES EOLIENNES**

(54) **Title: ECONOMICAL URBAN WIND TURBINE STATION (EUWTS)**



(57) **Abrégé/Abstract:**

Economical Urban Wind Turbine Station, EUWTS, is a multi level annulus structure which have plurality of wind turbines to generates clean energy from wind. EUWTS solves the inherent problems with current wind turbines including, too large land



**(57) Abrégé(suite)/Abstract(continued):**

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## **ECONOMICAL URBAN WIND TURBINE STATION (EUWTS)**

### **Abstract**

Economical Urban Wind Turbine Station, EUWTS, is a multi level annulus structure which have plurality of wind turbines to generates clean energy from wind. EUWTS solves the inherent problems with current wind turbines including, too large land needs, low output, high costs of KWH, output fluctuation, fossil fuel electricity back-up, noise, danger to birds and flicker effects.

EUWTS uses small wind turbines on protruded platforms of the multi level, annulus high structure where the small wind turbines have larger operational wind speed ranges than those of large wind turbines. EUWTS position the wind turbines on unprecedented high altitudes, and has maintenance tracks to maintain the wind turbines on internal platforms while other wind turbines are being operational.

EUWTS may use horizontal or vertical axis wind turbines, and may have hydrogen generation units which generate hydrogen, store it and regenerate electricity with constant characteristics of current, voltage and potential.

## **ECONOMICAL URBAN WIND TURBINE STATION (EUWTS)**

### **Description**

#### **Background and Description of the Related Arts**

Current related arts in wind energy use individual wind turbines to generate electricity from wind where are installed on altitudes range from several meters for small residential to 125m for industrial wind turbines, with nominal or tag capacities range from few KW to 5 MW. In addition, the current arts have inherent disadvantages such as: output fluctuation which requires fossil fuel back up generators to be used in combination with wind turbines in order for wind electricity to be usable and satisfies certain demand, too large land 8.5-33 Hectares /MW in Europe and USA respectively, too high noise, flicker effects, too low output, high installation and maintenance costs, and too high electricity costs. The capacity of fossil fuel generators shall be equal to the total capacity of wind turbines feed a grid. Economical Urban Wind Turbine Station or EUWTS is a unique design that solves the inherent problems with the current wind turbines. A search of the prior art by the failed to reveal any pertinent references.

#### **Problems with the State of the Arts**

Current state of the arts are utility wind turbines that have three foil blades operates on an approximately 100 m -125m high hip where they turn in vertical circular movements. These utility turbines have nominal ( max) capacities reached when wind speed is 10 to 12 m/s. the current state of the art wind turbines have some drawbacks such as:

- They take up too large areas of land in wind farms, 8.5-33 Hectares /MW in Europe and USA respectively or  $\sim 3-12 \text{ W/m}^2$ (Nominal) or  $\sim 0.6 -2.4 \text{ W/m}^2$  average real capacity where land between turbines is deemed to be out of their normal use because of noise and shade flickers.
- Current utility wind turbines have adverse effects on animals including killing birds and bats, This danger is not generated by EUWTS because of much lower blade speeds, much higher visibility of the structure where birds will avoid it and less forces if blades hit a bird, .
- Operational wind speed ranges 4-25 m/sec, where 12-25 m/sec the harvested energy by current state of the art wind turbines becomes constant, which means wasting much energy in wind especially on high altitudes where wind speeds are greater than 12 m/sec. For example, at altitude where wind speed is 24 m/sec, wind energy is 8 times more than wind speed 12 m/sec,

However, current utility wind turbines harvest only 1/8 of the available energy in wind and waste 7/8 of the energy available in wind.

-All current state of the arts wind turbines give low quality electricity that has irregular features in voltage, frequency and/or current. Electricity output varies with time as a normal result of irregular nature of wind speed over time. Consequently, current wind turbines must be backed up with fossil fuel base generators in order to supply electricity consistent with demand that makes the current wind turbines associated with carbon emission and deemed not a clean energy.

### **Description of EUWTS**

A Economical Urban Wind Turbine Station, EUWTS comprises a multi storey annulus-shape tower having a central vertical axis defining radially disposed interior and exterior frames made of beams and columns and said tower defining a plurality of vertically spaced horizontal levels comprising internal platforms extending between beams of said frames, and a plurality of wind turbines equally distant from each other along the periphery of the exterior beams. In addition the platforms in EUWTS are radially protrude beyond the exterior beams defining exterior platforms to support the wind turbines whereby said wind turbines capture wind power. Finally each of said wind turbines operatively connected to an AC or DC generator to produce electrical power. Moreover, EUWTS cross section is a circular, elliptical, rhombus or polygon. In another configuration, EUWTS might have elevators or lifts, for transporting equipment and personnel and are located adjacent to the interior frame. In another configuration, a EUWTS has top and bottom maintenance tracks for said wind turbine to guide and slide the wind turbine on said platforms, outwards to operational setting on said exterior platform, and inwards on said interior platform for maintenance, where the top and bottom maintenance tracks are horizontal and centered along the same vertical radial plane passes through the middle of the exterior and interior peripheral beams, and where the top tracks mirror the bottom tracks horizontally and where the maintenance tracks are supported by the tower beams. Said wind turbine, has a stationary axel, (3), ends at top and bottom with channel sections, (20) and (22), which fit snugly around said top and bottom tracks and wherein contacted surfaces of the tracks and channels are smooth and lubricated, and where the stationary axel is connected, near each end, to a short vertical half tube has internal diameter fits around and fixed to the stationary axel, and where each of the half tubes is connected to a short horizontal socket fits around a detachable maintenance rod (8) where both have aligned holes fit a short shaft to fix the rod to the stationary axel socket, and the

maintenance rod is attached in the same way from the other end to a maintenance post, (9), which has similar two short half tubes and socket near the top and near the bottom and where the maintenance rods, (8), run almost parallel to the maintenance tracks and where the maintenance post ends with channels at the top and bottom similar to those of the stationary axel and where the maintenance post fits between the bottom and top maintenance tracks and is free to slide along them when the post is not clamped to said exterior peripheral or ring beams which are parts of said exterior frames (10).

The maintenance post, (9), in claim 4 is fixed in place with two clamp sets, one near the top and the other near the bottom of the post where one part of each clamp set is fixed to the post and the other part of the clamp set is fixed to said ring beams wherein tightening the clamp sets pull the maintenance post tightly against the ring beams, and the post pushes the maintenance rods which push the stationary axel of the wind turbine against a plate fixed at the exterior end and perpendicular to the maintenance track and to the beams in a vertical plane, where the turbine movement along the tracks is restricted thereby and while tightening a screw going through side of said top channels against said stationary axel restricts the stationary axel from moving in a horizontal direction perpendicular to the tracks. The detachable horizontal maintenance rods or arms, (8) and maintenance post, (9), and clamps lock the wind turbine stationary axel in a direction parallel to maintenance tracks longitudinal axis when the wind turbine is in operational setting on the exterior platform, while if the wind turbine has a problem and need to be fixed, the clamps are released to free the post, then the post is pulled along the tracks until the turbine is on the internal platform, then said wind turbine passes the interior end of the tracks and is released from the tracks, and the maintenance arms might be detached for maintenance, and when maintenance is done the wind turbine is returned back to the operational setting on the exterior platform by sliding the turbine along the tracks and locked the post with the clamps.

EUWTS may have hydrogen based electricity generation units, HGU (13) are located in ground floor of the EUWTS and each unit includes, hydrogen generation units or HGU that is composed of electrolyzers fed by wind turbine output electricity after being converted to DC and transformation to proper low volt and high Ampere, and the HGU composed of water source and pure water tanks and pumps. HGU includes as well pressurizing pumps or liquefying and cooling equipments, hydrogen storage tanks, and fuel cell generators which produce non fluctuating with wind speed electricity.

EUWTS generates electricity from wind turbines on high altitudes by keeping high total operational capacity and continuous operation of the station by doing immediate and proper maintenance for broken wind turbines on the internal platforms by using said maintenance

tracks and said elevators or lifts, while the other wind turbines being operating. EUWTS uses appropriate ratio of height to smallest diameter of horizontal cross section of the EUWTS, where this ratio is smaller in regions with higher seismic design forces and in hurricane regions and where the EUWTS may reach 2,000 m height by using said appropriate ratio. EUWTS equipped with HGU produces electrical power from wind turbines where the electrical power output doesn't fluctuate with wind speeds and has stable frequency, current and voltage over time of supply which might be consistent with demand by transferring output electricity with appropriate voltage and ampere to the electrolysers to produce hydrogen from water then pressurizing the hydrogen or liquefying the hydrogen and store the hydrogen under pressure or as liquid in appropriate size and material tanks, then feeding the hydrogen to fuel cells to produce non fluctuating electrical power and consistent with demand despite wind speed changes over time, and which part of the regular electricity might be used to feed the pumps and the liquefaction equipments, then feeding electrical power to a grid. The frames of EUWTS usually are primed against corrosion and insulated for fire protection, and have sufficient number of distinguishers in all levels.

EUWTS transforms kinematical energy in wind to electricity using small wind turbines. Small wind turbines have larger range of operational speeds and are installed easier than utility wind turbines and are installed on higher altitudes than current state of the arts wind turbines, and much closer to each other because their blades run much slower than large wind turbines. Then, when EUWTS is combined with electrolysers and fuel cells gives consistent with time and normal high quality electricity that makes EUWTS a real clean energy alternative to current energy industries. While using electrolysers and fuel cells with current utility wind turbines is almost impossible because that will increase electricity costs about 4 times to already too expensive electricity.

The installation of wind turbines on a large height of an EUWTS tower that reaches several hundred meters, increases the capacity of wind turbines considerably as wind speed increases noticeably with height up to 275 m (900ft) and then increases less sharply. The available wind energy is proportional to wind speed to the cubic power. That means there is much more available energy from wind on high altitudes than on low altitudes.

The main assumption in EUWTS design is that only half of the installed wind turbines on windward direction work at a time, while the other half on the leeward is at halt at the time until wind direction changes and trigger other set of the wind turbine in the windward side to start up and generate electricity.

EUWTS operates in larger wind speeds than the state of the arts, large wind turbines, because the tip speed of small wind turbines used in EUWTS is much smaller than the state of the art wind turbines in the same wind speed environment. The tip speeds are smaller by a ratio of the diameter of the large wind turbines to small wind turbines. Large wind turbines usually work at wind speed up to 20-40m/sec and give constant output when wind speed is greater or equal 12m/sec.

This range of speeds will be a few times larger when the generated electricity is not supplied to a grid but used to generate hydrogen where the variation in frequency is not an issue. This larger operating wind speed range allows harvesting larger amount of energy that are available at higher wind speeds and increases the operational time and thus wind turbine efficiency. In addition, availability of EUWTS turbines to operate is maximized by continuous maintenance of wind turbines around the year, where some wind turbines are being maintained, all the others are operating.

In addition, the large covered space in ground level is used to generate hydrogen from water using the output electricity of wind station, and store generated hydrogen to use it with fuel cell to regenerate refined and consistent (constant frequency, voltage and current) electricity over time and with demand, then making wind power more reliable.

EUWTS capacities range from several MW to more than 5,000 MW average real power capacity at sites with annual average wind speed 6 m/s (13.5 Mile/h) at 10m height. In addition, EUWTS takes ~0.5 % of space required for the current large wind turbines considering similar capacity factors. EUWTS allows continuous using of lands in the vicinity of wind stations, where noise is usually lower than ambient levels on distance estimated less than a hundred meter off the turbines.

In conclusion, EUWTS eliminates almost the inherent disadvantages of the current utility wind turbines such as noise, shade flickers, too much land needs, danger to birds, limited power output and vulnerability to high wind speeds larger than 10-12m/sec, small wind speed operative range, short life cycles, low operation hours and high costs of construction and maintenance.

EUWTS is a novel design which exposes wind turbines to high altitude winds which highly increases wind speeds, uses small wind turbines which has much larger ranges of operating wind speeds and provides for greater hours of operations by providing continuous maintenance of individual wind turbines. As a result EUWTS increase output generated electricity in a unit swept area by many times which means generating cheaper electricity and allows for storing the wind energy in a medium then regenerate regular electricity consistent with demand.

## Drawings

EUWTS drawings are illustrated in Figures 1-5, The numbers in the drawings are as follows.

1. Blades.
2. External rotating vertical axel.
3. Internal fixed vertical stationary axel
4. Short half cylindrical tube connects internal fixed vertical axel to maintenance arm or bar.
5. Top and bottom bearings guide and carry rotating rotor around internal fixed vertical axel.
6. Gear box transfers motion from external axel to electricity generator.
7. Electricity generator.
8. Maintenance bars or arms, a part of the maintenance frame.
9. Maintenance post connected to the two maintenance bars.
10. Ring and other principal frame beams that connected directly to the frame columns.
11. Frame columns.
12. Secondary and tertiary frame beams supporting platforms.
13. Hydrogen based electricity generation units include hydrogen generation units, hydrogen storage tanks, fuel cell generators, and pumps.
14. Exterior horizontal platforms support wind turbines.
15. Horizontal maintenance channels.
16. Maintenance track cover with bent up hangovers to go over the bent up lips and bent up lips to protect the maintenance track from falling dirt and water.
17. Maintenance track base plate.
18. Maintenance track supporting members that in turn are supported by secondary or main beams.
19. Bottom maintenance track fixed into horizontal maintenance channel housing.
20. Channel fits around the bottom track snugly and lubricated for easier sliding.
21. Top maintenance track come with bolt to be tightened in the operation setting.
22. Channel may slide under the top maintenance track while can't move when a side bolt is tightened against the top maintenance track.
23. Service elevators or lifts.
24. Concrete individual or mat foundations
25. Extended exterior platform in first floor works as shield.

Figure 1- Shows EUWTS wind station plan when the cross section of the tower is circle and when wind turbines are vertical axis.

Figure 2- Is side view of the EUWTS wind station in Figure 1,

Figure 3- Illustrates a plan view of one of the wind turbines in the EUWTS, in an operational setting on an exterior platform,

Figure 4- Illustrates side view of the wind turbine in the EUWTS in an operational setting,

Figure 5- Shows section A-A of the wind turbine in the EUWTS in an operational setting,

**Claims**

I claim:

1. An Economical Urban Wind Turbine Station, or EUWTS comprising:
  - a) a multi storey annulus-shape tower having a central vertical axis defining radially disposed interior and exterior frames made of beams and columns and said tower defining a plurality of vertically spaced horizontal levels comprising internal platforms extending between beams of said frames, and
  - b) a plurality of wind turbines equally distant from each other along the periphery of the exterior beams,
  - c) said platforms radially protrude beyond the exterior beams defining exterior platforms to support the wind turbines whereby said wind turbines capture wind power,
  - d) each of said wind turbine operatively connected to an AC or DC generator to produce electrical power.
2. A station as in claim 1, has a circular, elliptical, rhombus or polygon cross sections.
3. A station as in claim 1, comprising elevators or lifts, for transporting component of the station and transporting personnel between ground level and all levels in said tower of claim 1, wherein the lifts and elevators are located normally adjacent to said interior frame.
4. A station as in claim 1, comprising top and bottom maintenance tracks to guide and slide said wind turbines on said platforms, outwards to operational setting on said exterior platforms, and inwards on said interior platforms for maintenance, where the top and the bottom maintenance tracks are horizontal and centered along one vertical radial plane passes through middle of said exterior and interior peripheral beams of said station frames, and where the top maintenance tracks mirror the bottom tracks horizontally and where the maintenance tracks are supported by said tower beams.
5. A station as in claim 1, wherein said wind turbine has a stationary axel, (3), ends at top and bottom with channel sections, (20) and (22), which fit snugly around said top and bottom tracks and wherein contacted surfaces of the tracks and channels are smooth and lubricated, and where the stationary axel is connected, near each end, to a short vertical

half tube has internal diameter fits around and fixed to the stationary axel, and where each of the half tubes is connected to a short horizontal socket fits around a detachable maintenance rod (8) where both have aligned holes fit a short shaft to fix the rod to the stationary axel socket, and the maintenance rod is attached in the same way from the other end to a maintenance post, (9), which has similar two short half tubes and socket near the top and bottom and where the maintenance rods, (8), run almost parallel to the maintenance tracks and where the maintenance post ends with channels at the top and bottom similar to those of the stationary axel and where the maintenance post fits between the bottom and top maintenance tracks and is free to slide along them when the post is not clamped to said exterior peripheral or ring beams which are parts of said exterior frames (10).

6. A station as in claim 1, wherein said maintenance post (9), in claim 5 is fixed in place with two clamp sets, one near the top and another near the bottom of the maintenance post where one part of each clamp set is fixed to the post and the other part of the clamp set is fixed to said ring beams, wherein tightening the clamp sets pull the maintenance post tightly against the ring beams, and the post pushes the maintenance rods which push said stationary axel of said wind turbine against a plate fixed in a vertical plane, at exterior end of, and perpendicular to said maintenance track and to said beams, where the turbine movement along the tracks is restricted thereby and while tightening a screw going through a side of said top channels against the stationary axel, restricts the stationary axel from moving in a horizontal direction perpendicular to longitudinal axis of the maintenance tracks.
7. A station as in claim 1, wherein, said detachable horizontal maintenance rods or arms, (8) and maintenance post, (9), and clamps, in claims 5 and 6, lock said wind turbine stationary axel in a direction parallel to said maintenance tracks longitudinal axis when the wind turbine is in operational setting on said exterior platform, while if the wind turbine has a problem and need to be fixed, the clamps are released to free the post, then the post is pulled along said maintenance tracks until the turbine is on the internal platform, then the wind turbine passes interior end of the maintenance tracks and is released from the tracks, and the maintenance arms might be detached from the post to free the wind turbine for maintenance, and when maintenance is done the wind turbine is returned back to

operational setting on said exterior platform by sliding the wind turbine along the tracks and locked the post with the clamps.

8. A station as in claim 1, wherein hydrogen based electricity generation units are located at the multi storey structure, each unit comprising known electrolyzers fed by electricity generated by the wind turbines after the electricity has been converted to DC and transformed to proper low voltage and high amperage, the electrolyzers producing hydrogen; the hydrogen operating fuel cell generators which generate non-fluctuating electricity.

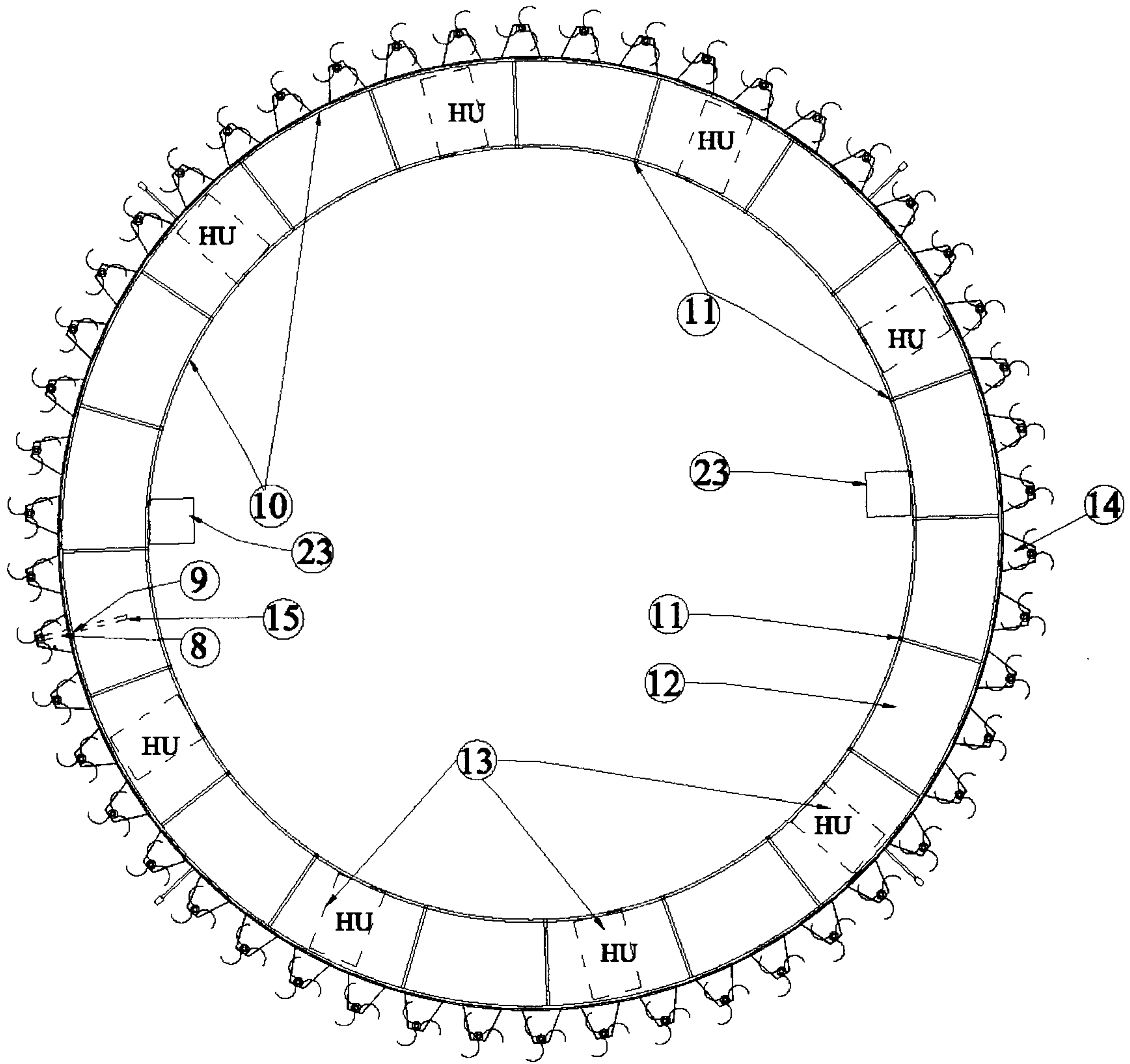


Figure 1

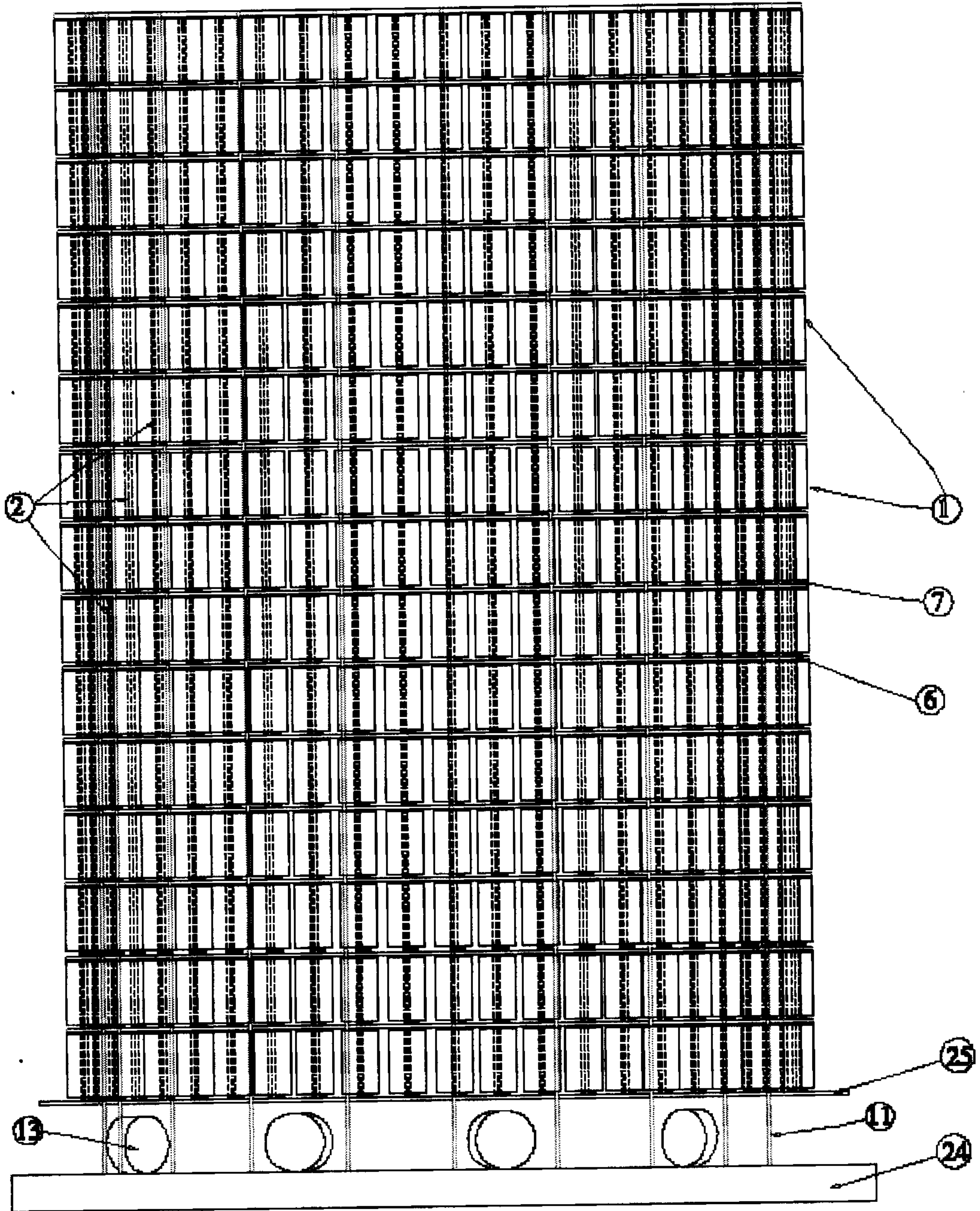


Figure 2

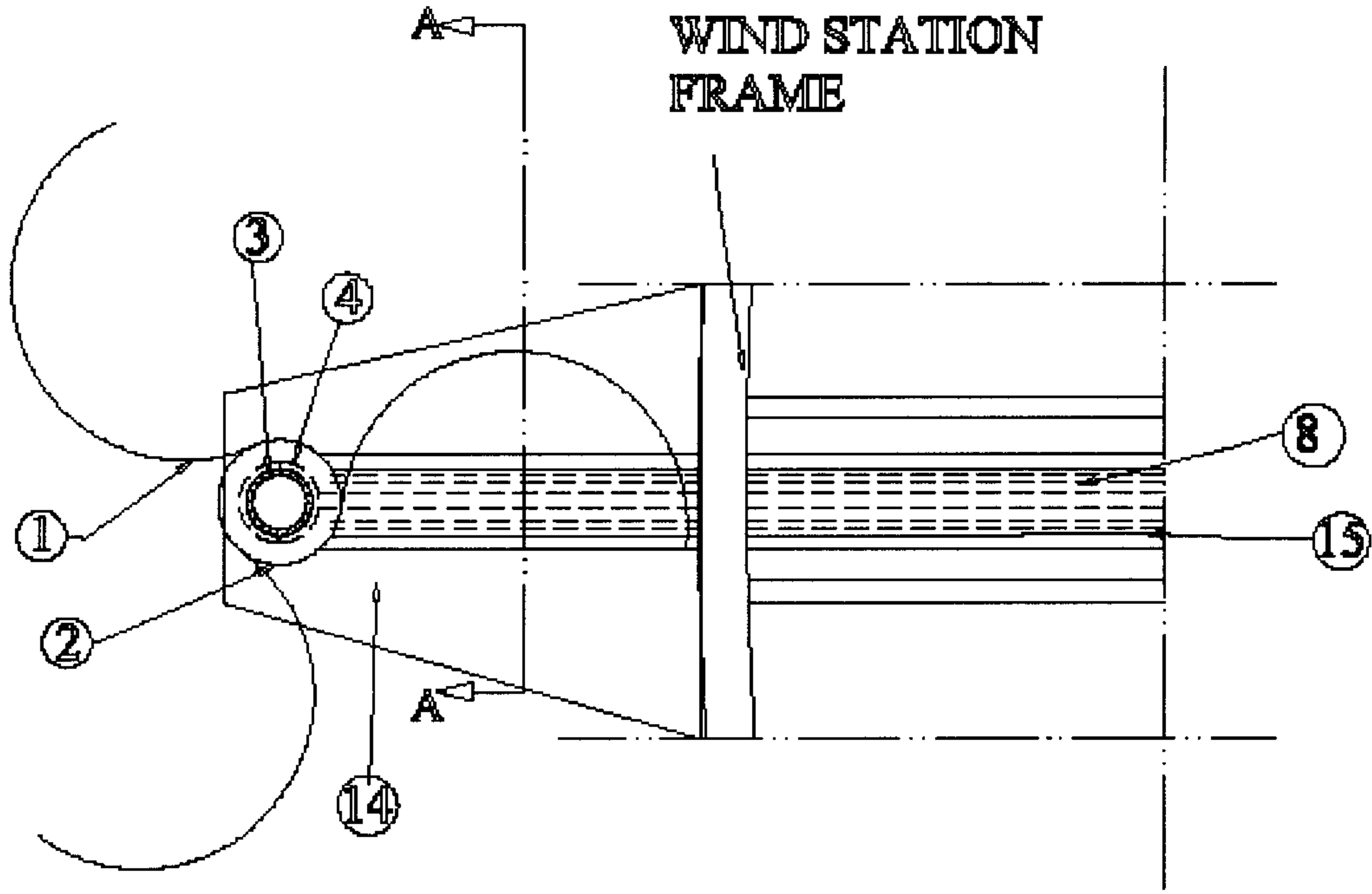


Figure 3

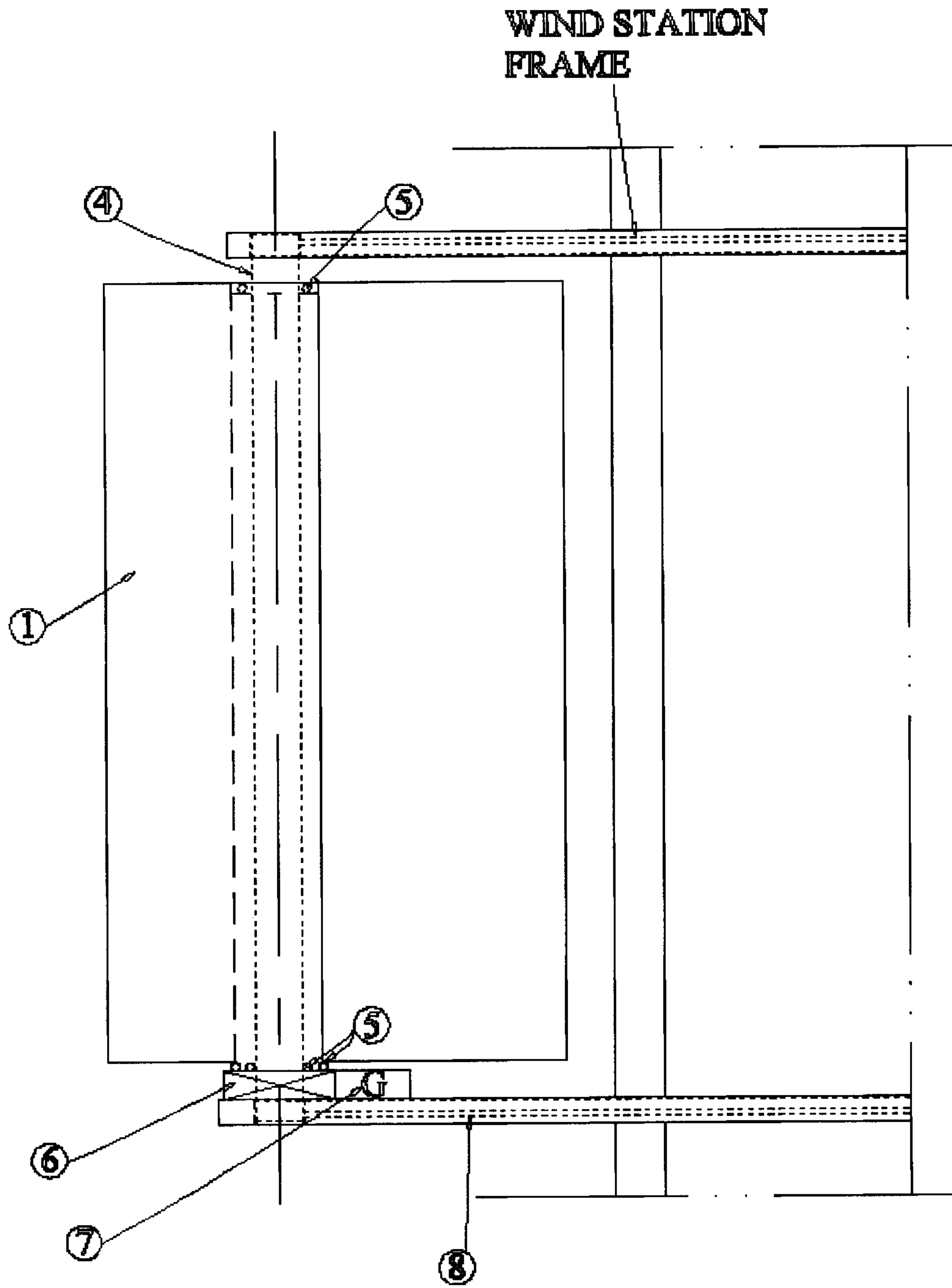


Figure 4

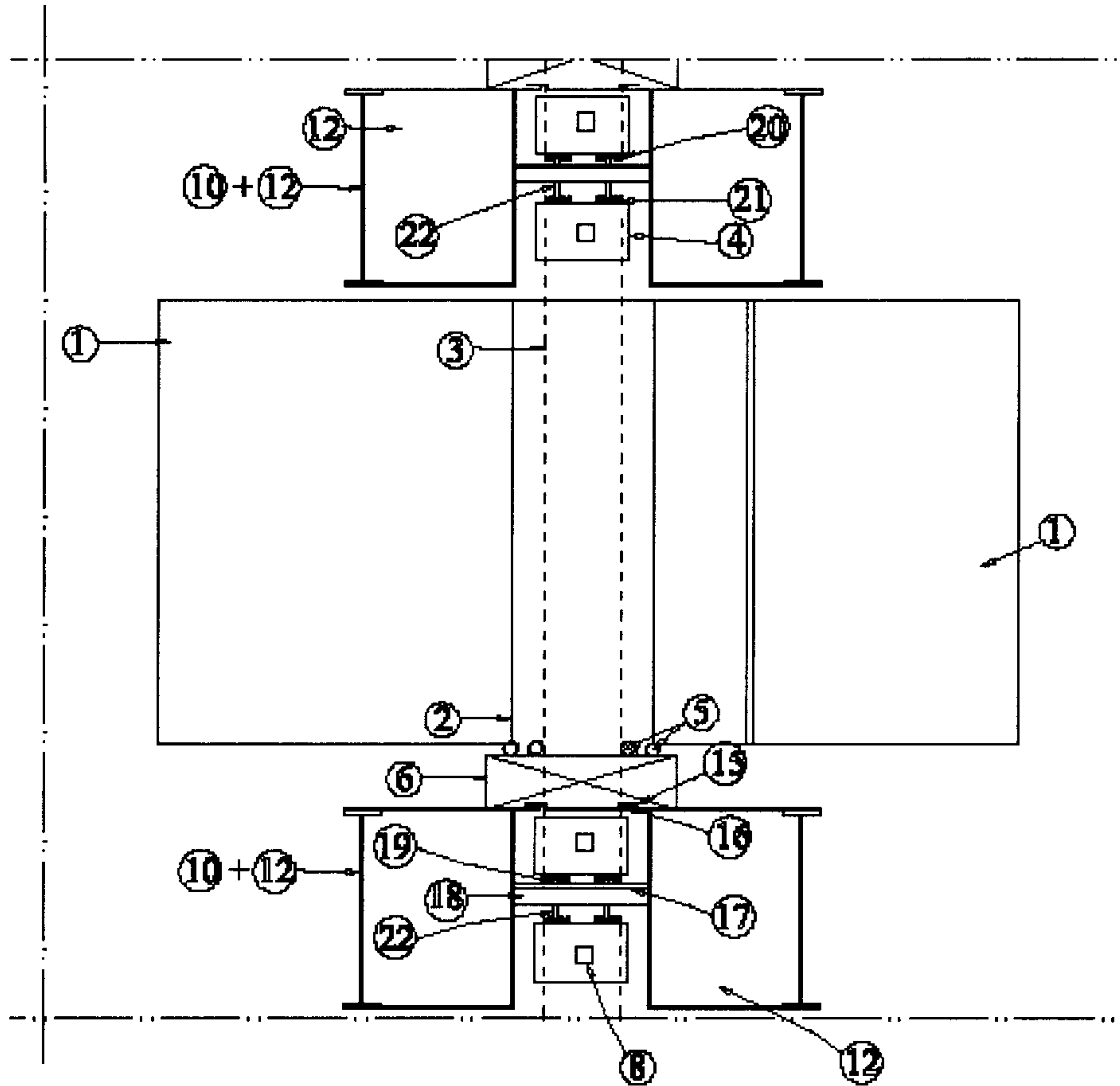


Figure 5

