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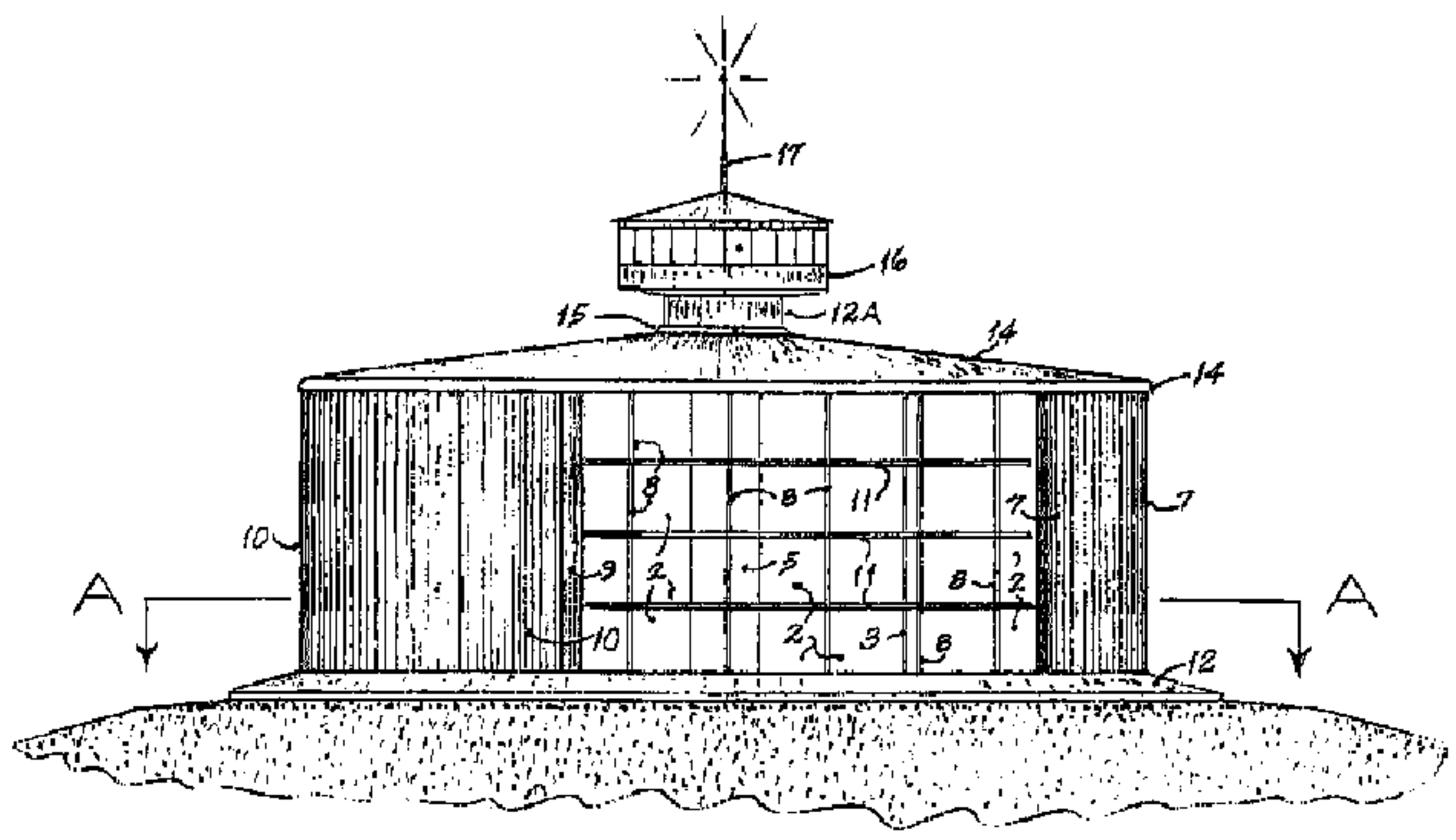
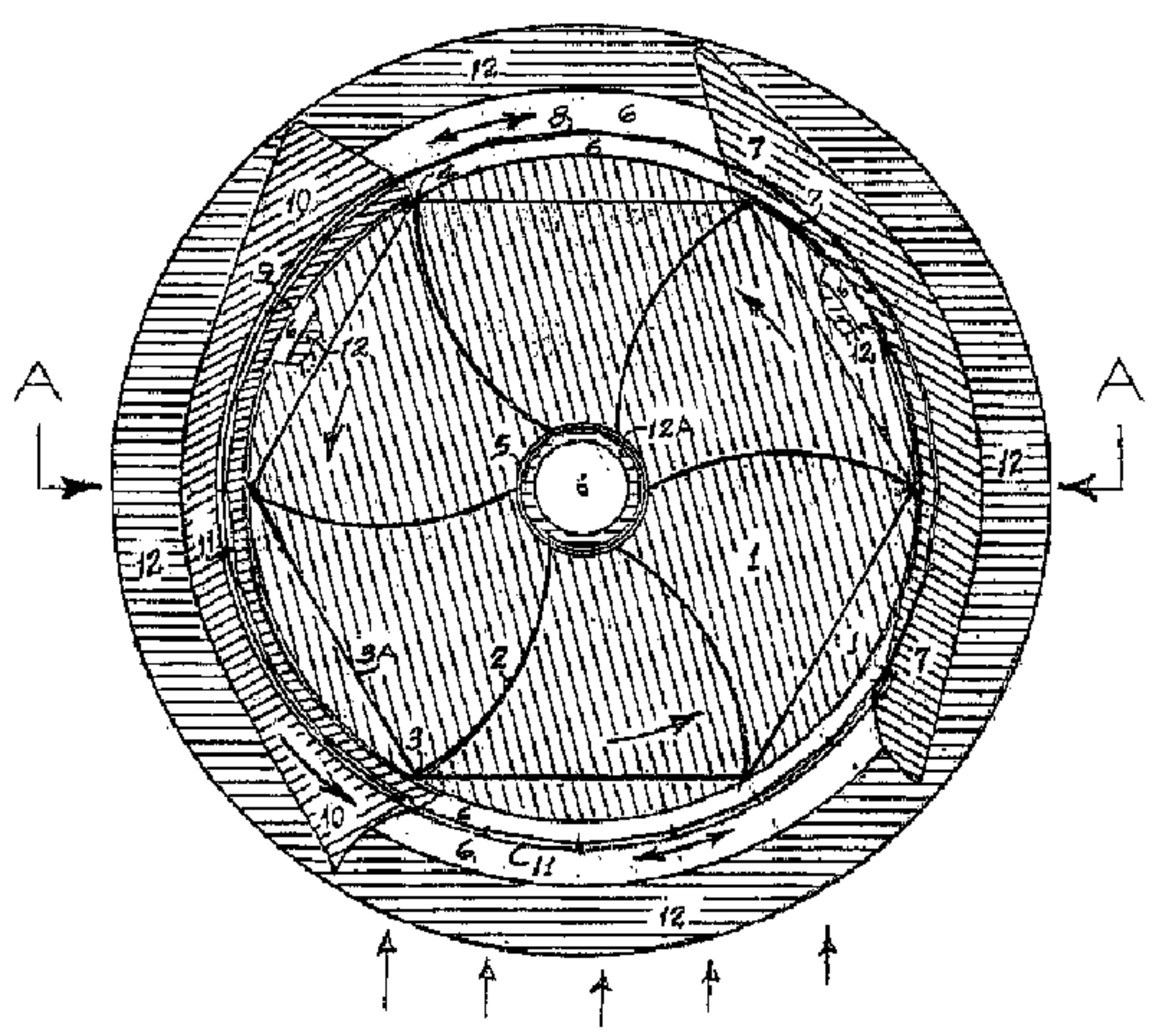
(54) Title: WIND TURBINES WITH POSITIVE DISPLACEMENT INTAKE ENHANCEMENT AND APERTURE CONTROL





(57) Abrégé/Abstract:

This invention relates to new and useful improvements in wind turbines, to achieve significant gains in efficiency over present state of the act. With intake enhancement, aperture control and positive displacement, this invention will have higher energy

(57) **Abrégé(suite)/Abstract(continued)**:
output than present state of the art systems. Aperture control allows for useful power output from very low to exceedingly high wind speeds, and positive displacement provides higher levels of torque at lowest wind speed. The end result is that rather than producing useful power output as little as 30% of the time, as experienced with present systems, this invention should be able to double that performance quite easily.

WIND TURBINES WITH POSITIVE DISPLACEMENT INTAKE ENHANCEMENT AND APERTURE CONTROL

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This invention relates to new and useful improvements in wind turbines, to achieve significant gains in efficiency over present state of the art. With intake enhancement, aperture control and positive displacement, this invention will have higher energy output than present state of the art systems. Aperture control allows for useful power output from very low to exceedingly high wind speeds, and positive displacement provides higher levels of torque at lowest wind speed. The end result is that rather than producing useful power output as little as 30% of the time, as experienced with present systems, this invention should be able to double that performance quite easily.

BACKGROUND OF THE INVENTION

The inventor had studied and critically examined examples of present state of the art, and concluded that the matter of harnessing wind power needed to be seriously improved in the following areas: 1. Provide comparatively high levels of torque at all wind speeds, from the lowest average to gale force wind speeds. 2. Begin developing useable power output at very low wind speed. 3. Extend the wind speed operating range of wind power systems or turbines. 4. A serious reduction in wind powered electrical energy cost per kilowatt is needed to justify the broader application of wind power as a viable energy source, so economics of scale must be considered.

The inventor had been advised that present state of the art wind power systems, particularly as installed in the Province of Alberta, are only capable of providing useful power less than thirty percent of the time. They are not capable of useful output until a minimum wind speed is available, in the order of 15 miles or 24 kilometres per hour. A second serious limitation, is that they have to apply pitch control, and even go to neutral, plus applied braking or shutdown, to tolerate gale force wind speed. Those limitations are indeed unfortunate, and the inventor, through this invention, expects that such limitations will not apply at either very low, or gale force wind speeds.

OBJECTS OF THE SUBJECT INVENTION

Objects of the subject invention are based on the above observations, and the further fact that wind power is an ideal and proper energy source which is environmentally safe, continuous and renewable. The inventor had decided that wind power should be accessible at all normal wind speeds up to the level of gale force winds and beyond. Also, that wind power systems should be built in a large enough size range to provide useable electrical energy in the megawatt range of output at reasonable cost. One last object is that if we are going to phase out and eventually eliminate atmospheric and environmental pollution from our hydrocarbon fuelled systems, more efficient wind power systems, built to larger scale can make a significant contribution toward that end result.

IMPROVEMENTS OVER PRESENT STATE OF THE ART

Improvements over most versions of present state of the art, are:
1. Positive displacement. **2.** High torque output at lower wind speeds.
3. Aperture opening areas much larger than turbine blade cross-section areas, providing a significant increase in wind pressure against turbine blades, to enhance energy output at lower wind speeds. **4.** Adjustable aperture size and area, for improved safety, prevention of overloading, and the augmentation and better control of turbine rotor speed within a broad range of wind speeds. **5.** The elimination of costly and complex mechanical devices as used for controlling and neutralizing pitch in present state of the art propeller types of wind power systems and machines. **6.** Maximum size and electrical or mechanical output potential can be very large for versions of this invention, resulting in seriously lowered cost per unit of energy output. **7.** This invention is suited for potential placement wherever there is a normal constant wind speed of ten miles or sixteen kilometres per hour. **8.** Embodiments of this invention can be more quiet in their operation, more aesthetically pleasing in appearance, and much more productive for land area dedicated to their use.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a side view of a preferred embodiment of the invention with single turbine rotor and horizontal axle, mounted on a typical tower framework, with its rotor and rotor housing shown as a cutaway view to more clearly illustrate its basic functional details.

Figure 2 is a frontal view of the same embodiment, more completely illustrating its wind capture aperture and relative rotor placement, as it would appear in operating mode, with wind capture aperture set to full opening position.

Figure 3 is a cutaway vertical view of a second and much larger embodiment of the invention with single turbine rotor and vertical axle, mounted onto a solid concrete base, inside of, and surrounded by a rotatable housing framework.

Figure 4 is a frontal view of the same embodiment, as shown in Figure 3, more clearly illustrating its frontal aperture and building structure, located on a prepared mound or hilltop as it would appear in operating mode, with intake aperture in fully open position.

With all of the foregoing in view, and such other or further purposes, advantages or novel features as may become apparent from consideration of this disclosure and specification, the present invention consists of the inventive concept which is comprised, embodied, embraced or included in various specific embodiments of such concept, reference being made to the accompanying figures, in which..

Figure 1 is a right side cutaway view of a preferred embodiment of the subject invention, where the turbine rotor assembly consists of flat circular end plate 1, curved turbine blades 2, blade tip strengthening and reinforcement rods or tubes 2A, centre axle 3, and blade structural reinforcement tubes, or cables, 4.
The turbine rotor is contained, housed and structurally supported within fixed sections or components of its housing consisting of fixed components 5, wind intake aperture 5A, wind exit aperture 5B, and partially rotatable top aperture door 6, shown with intake aperture at full opening position, and where door 6, can be rotated closely concentric to and outside of the turbine rotor, by as much as 30 degrees of arc, thereby closing down the wind intake aperture to the bottom of the arc of its motion, indicated by the path of arrows 5C. This results in a fully opened aperture area of more than two and a half times the surface area of a turbine blade, and a fully closed aperture area of less than the surface area of a turbine blade. This provides a desirable range of wind intake, to gain maximum torque at lowest wind speed, and to control upper levels of torque at highest wind speed. Further rotation of door 6, to full closure is also contemplated, to avoid system damage in the case of exceptionally high wind speed.
The turbine body, or housing, is mounted and firmly held on a round encased track, with its outer encasement ring 7, being illustrated, where, by means of a motorized gear drive, and automated wind sensing device, the wind intake aperture 5A is centred toward the prevailing wind direction, automatically, as with propeller driven wind power units of present state of the art.
The said round encased track has its base welded, bolted or firmly affixed to the top ends of supporting tower legs and sub frame members 8, and an area to house desired drive system and generator components and associated accessories has solid floor 9, and is surrounded by outside wall 10. Entry door or aperture, and ladder assembly, and essential mechanical details are not shown, as such are easily designed and properly engineered by persons skilled in the art.

Figure 3 is a cutaway vertical view of the basic elements of a second preferred embodiment of a wind turbine with rotor of similar configuration, mounted with its centre axle in vertical position, and which can be built to very large proportions, and:
The turbine rotor consists of flat circular end plate 1, blade 2, of which there are six, blade tip reinforcement rod or tube 3, at the outward end of each blade, tensioning and stiffening cables 3A, of which there are three complete sets at the same elevations as roller track 11, and horizontal elements of structural support ring, 8, rotor blade tip sealing strips 4, of resilient material, such as belting, to seal the rotor blade tips off from rotor encasement walls 7 and 9, for wind pressure containment, then we have centre axle tube 5, to complete the turbine rotor assembly.
The rotor rests above, and is surrounded, slightly below and inside the outer circumference of its base or bottom end plate, and continuing outward therefrom, by wind directional rotator ring disc 6, with right hand rotor encasement wall 7, and left hand rotor encasement wall 9, firmly and permanently mounted thereon, and adjustable front aperture closure wall 10, resting thereon, supported by bottom rollers (not shown). Wind directional control, with supporting instrumentation and drive system, etc., for wind directional rotator ring disc 6, is common to present state of the art, and easily applied by those skilled in the art.
Adjustable front aperture closure wall 10, is supported in accurate vertical position on top of wind directional rotating disc 6, with its separate rotational path accurately defined and controlled by roller track mountings with built-in, adjustable tracking and retaining rollers (not shown), which are firmly and accurately attached to the interior sub-frame of front aperture closure wall 10, and snugly mounted with its rollers properly aligned, to horizontally positioned roller track 11, built onto structural support ring system 8, at all three of its elevations, continuing for the full arc of front aperture closure wall 10, and proceeding further to a point inside right hand rotor encasement wall 7, where roller track 11, ends.
The turbine rotor, along with wind directional rotator disc 6, with appurtenances thereon, are all mounted and resting on complete and composite reinforced concrete floor and basement 12, with vertically rising concrete axle tube 12A.
Wind directional rotator disc 6, with appurtenances thereon, and the turbine rotor are each mounted and resting upon floor and basement assembly 12, by means of adequate roller track and rollers as to rotator disc 6, and by means of an oil bath bearing of large diameter and surface area, at its bottom, and an upper end centreing collar and bearing around axle tube 12A, as to the turbine rotor.
Although the roller track assembly and oil bath bearing, centering collar and associated bearing are not shown, they are not a serious challenge for experienced Engineers or technicians skilled in the art.
Centre opening 13, in concrete axle tube 12A, would accommodate an encased elevator shaft, surrounded by a narrow spiral stairway, for access to the basement area, with mechanical system and generators, and further to just below

the roofline of office and control room structure,16, above the roof, as later described herein.
Figure 4 is a frontal plan view of the same wind turbine as shown in Figure 3, as a complete installation, in operating mode, with its front aperture set at full open position, providing a cross-sectional area for wind capture, which is more than double the square footage surface area of a single wind turbine blade. Wind intake aperture closure wall 10, can be progressively closed in chosen increments, to assure preferred turbine rotor speed, at progressively higher wind velocities, up to hurricane force levels, and the aperture closure wall 10, can further be closed completely, to the point where the curved inside frontal face of right hand rotor encasement wall 7, will fit closely against the oppositely curved inside frontal facing surface of wind aperture closure wall 10. This allows for maximum safety in hurricane force winds, and also for safe turbine shutdown for essential servicing when required.
Items previously described, as we covered Figure 3, are all shown where they would be visible in our view of Figure 4.
To continue with our detailed description, the roof, 14, is made of light, high strength materials, and is built upon and firmly affixed to the turbine impeller, and its downward facing side is the top end plate of the turbine impeller. There are three reasons for this, where firstly, aperture closure wall 10, must be able to move freely as required to serve its closure function, and secondly, with the roof rotating along with the impeller, virtually nothing will be able to attach to the said roof, to cause any problems, as to servicing, etc., and thirdly, the roof can be made much lighter, and probably more economically, if it does not have to be held up by long span support beaming. The said roof 14, is sealed off around the outer perimeter of axle tube 12A, by a flashing type ring of metal, 15, and attached to the bottom outer edge surface of the said flashing ring is a resilient material, such as a form of synthetic rubber, or belting material, which would slide on top of the roof beyond its apex opening, providing an effective seal against water or particulates which might effect the top stabilizer bearing (not shown) of the turbine impeller. The outer perimeter facing of roof 14, is slanted downward, and the underside of its extension over rotor encasement walls 7 and 9, and aperture closure wall 10, is enclosed and flat surfaced to rotate with very small clearance between the said underside extension and the said walls 7, 9, and 10. The main reason for this is to avoid problems which might occur as extreme winds are encountered.
Axle tube 12A, extends upward, through and above roof 14, continuing upward through and to the top inside, just below the roof of a circular building, or enclosure, 16, which looks like an observation deck, and which would serve as an operating office, with instrumentation and control panels etc., as normally required for an electrical power generating facility. Extending from the top centre of the roof of said circular enclosure 16, is combination antenna and light pole 17, with wind direction and velocity measuring devices mounted thereon, as would be normally required for such a facility.

Based on the foregoing detailed description, together with further related comments and explanations, the objects of the subject invention, as set forth herein above have been addressed adequately, and are easily achievable. Also, while there is shown and described presently preferred embodiments of the invention, it is understood that the invention is not limited thereto, but may be otherwise variously embodied and applied within the scope of the following claims. Accordingly,

~~What is claimed is:~~

1. A wind turbine which operates, or is powered on the basis of the wind being channelled toward, into, and against its rotor blades, and where its rotor is of a fixed displacement type, somewhat like that of a water turbine.

2. A wind turbine which operates, or is powered on the basis of positive displacement, where the outer edges or tips of the blades of its rotor are sealed against a closure housing surrounding a portion of the of the rotor, to assure minimal pressure losses, thereby enhancing its potential output.

3. A wind turbine which has its wind intake adjustable by means of a progressively closable intake aperture, to allow the said turbine to continue harnessing wind power at very high wind speeds, rather than having to be shut down to avoid being damaged.

4. A wind turbine whose characteristics are such that it is driven or powered primarily by wind pressure, applied to turbine blades of substantial surface area, with positive displacement, to harness a maximum amount of wind energy.

5. A wind turbine which is able to provide useable power output at a very wide range of wind speeds, from as little as 15 kilometres per hour, to excessive wind speeds beyond 100 kilometres per hour.

6. A wind turbine which has a variable, and aerodynamically efficient intake aperture system, which is adjustable as to its opening, and can further be completely closed for ultimate safety, servicing and maintenance.

7. A wind turbine which can be built in a broad range of sizes, up to the ultimate ~~limitations of engineering skills, materials, and structural integrity.~~

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4. A wind turbine whose characteristics are such that it is driven or powered primarily by wind pressure, applied to turbine blades of substantial surface area, with positive displacement, to harness a maximum amount of wind energy.

5. A wind turbine which is able to provide useable power output at a very wide range of wind speeds, from as little as 15 kilometres per hour, to excessive wind speeds beyond 100 kilometres per hour.

6. A wind turbine which has a variable, and aerodynamically efficient intake aperture system, which is adjustable as to its opening, and can further be completely closed for ultimate safety, servicing and maintenance.

7. A wind turbine which can be built in a broad range of sizes, up to the ultimate limitations of engineering skills, materials, and structural integrity.

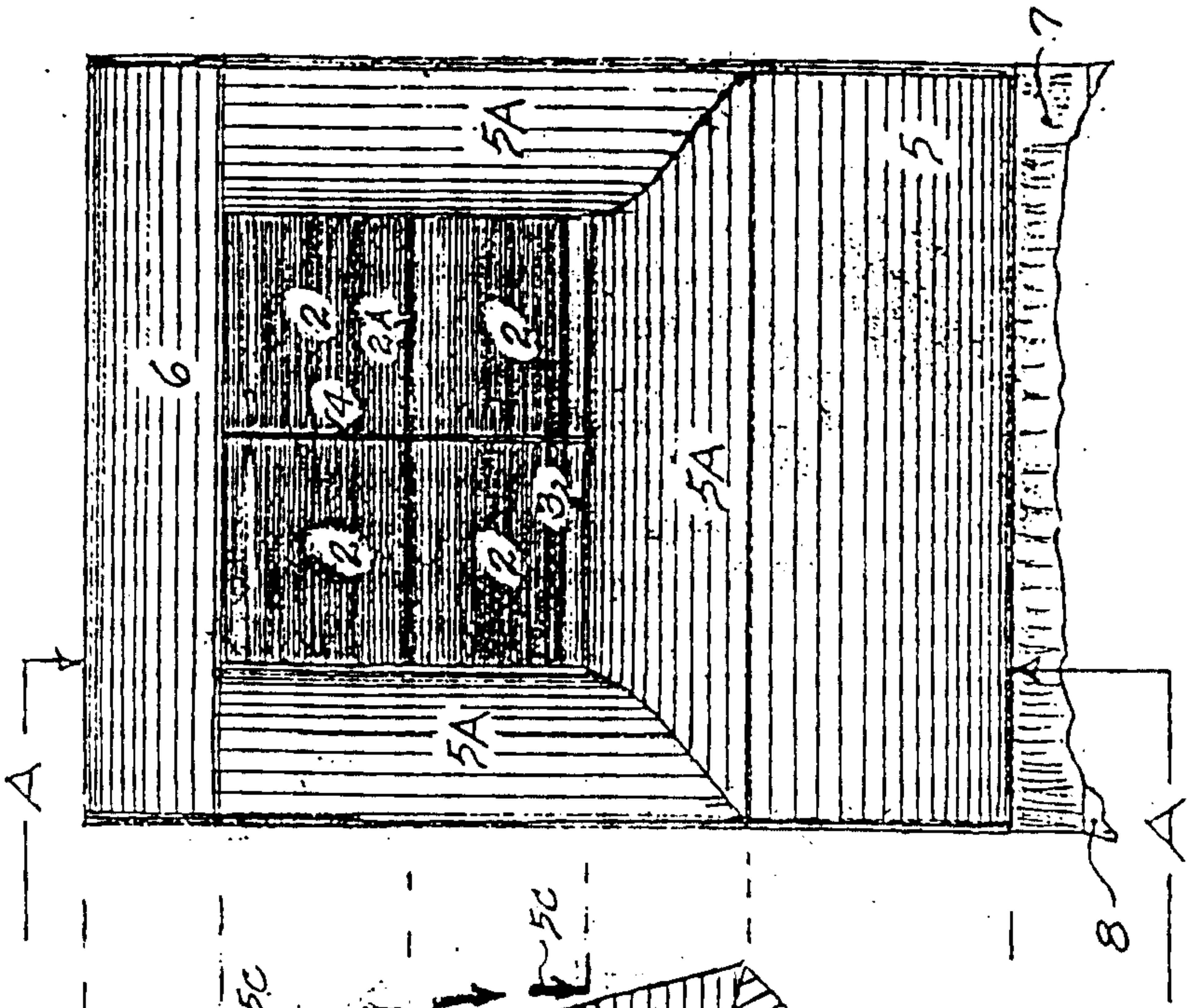


FIGURE 2

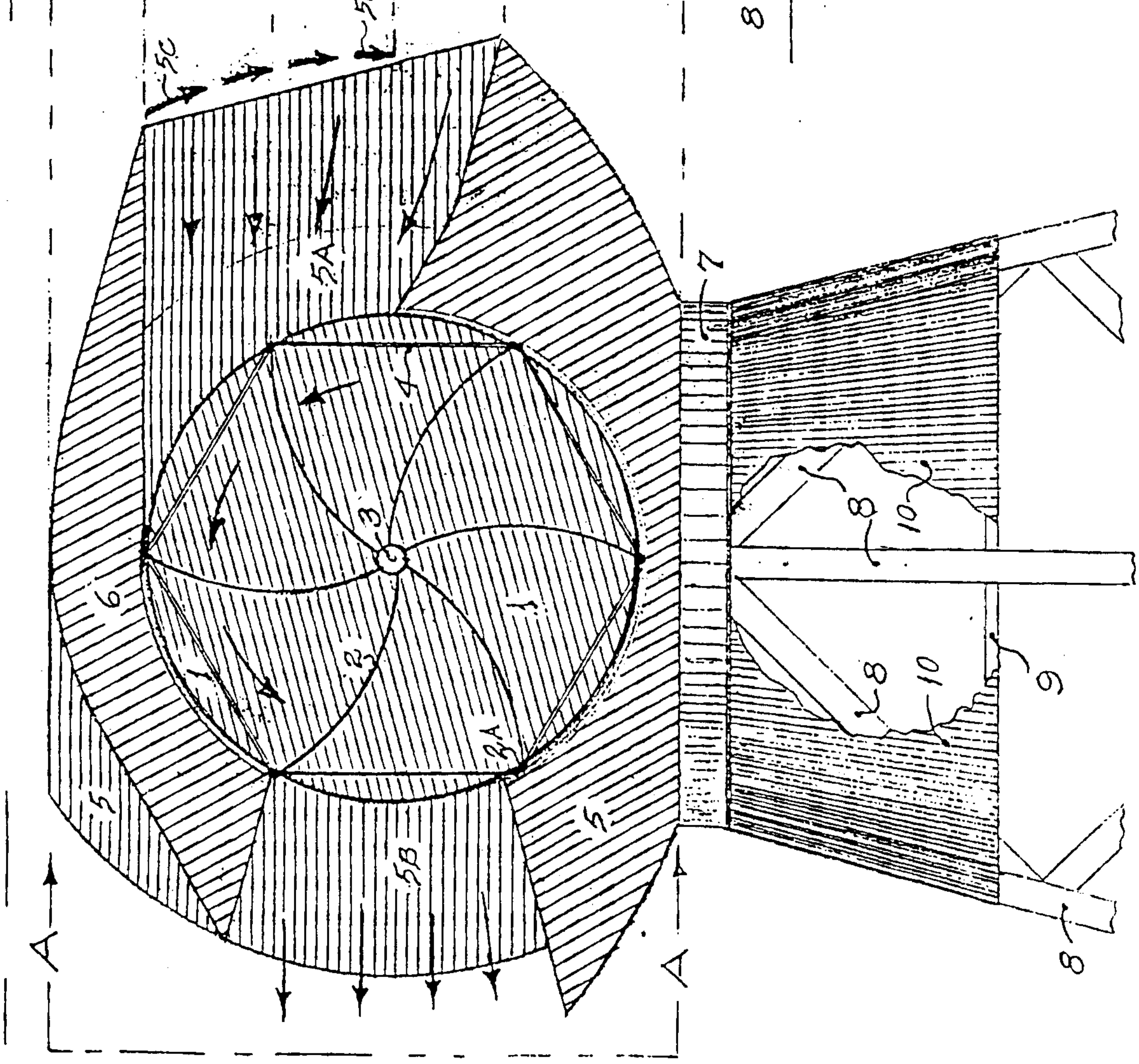


FIGURE 1

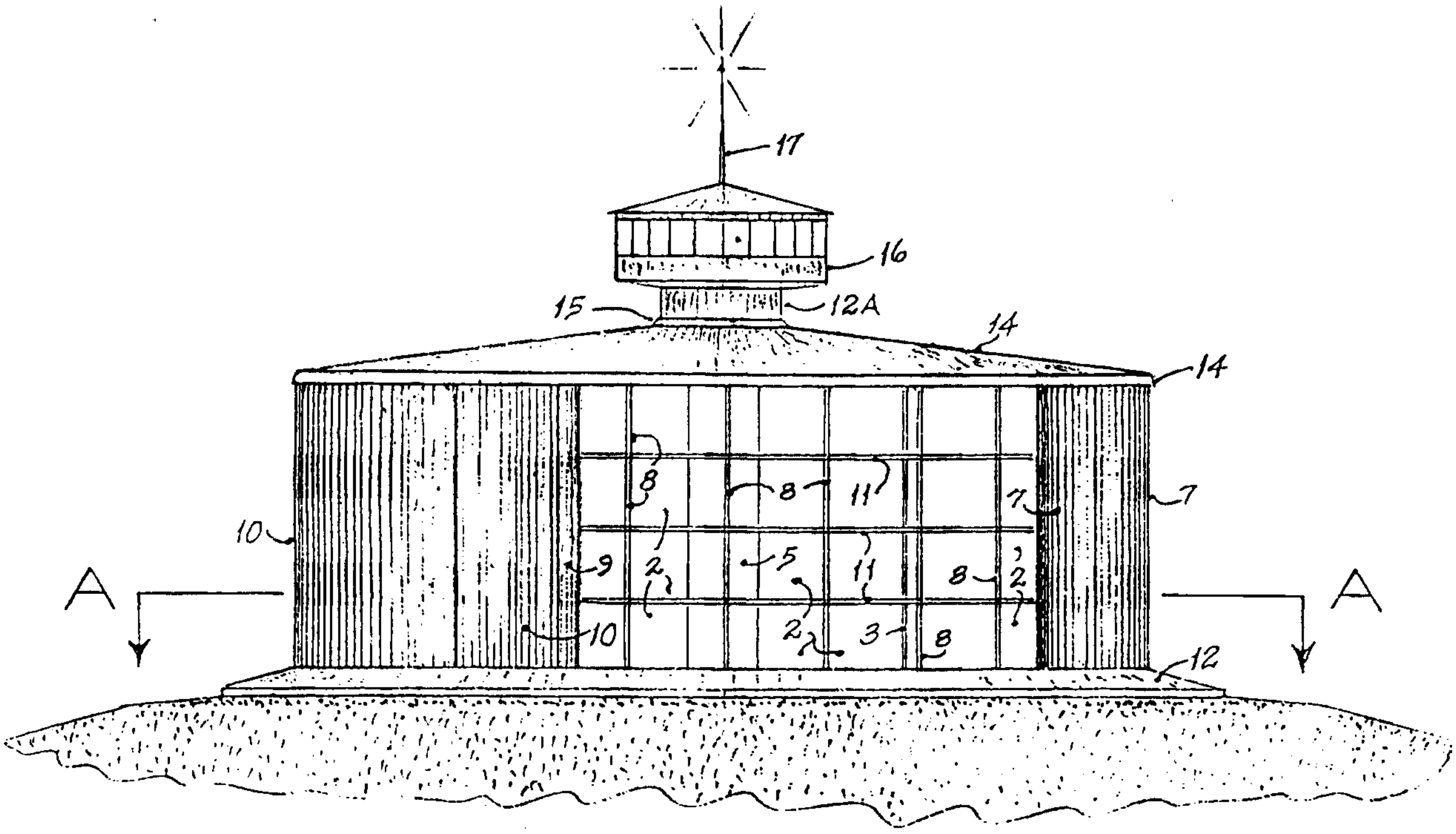


FIGURE 4

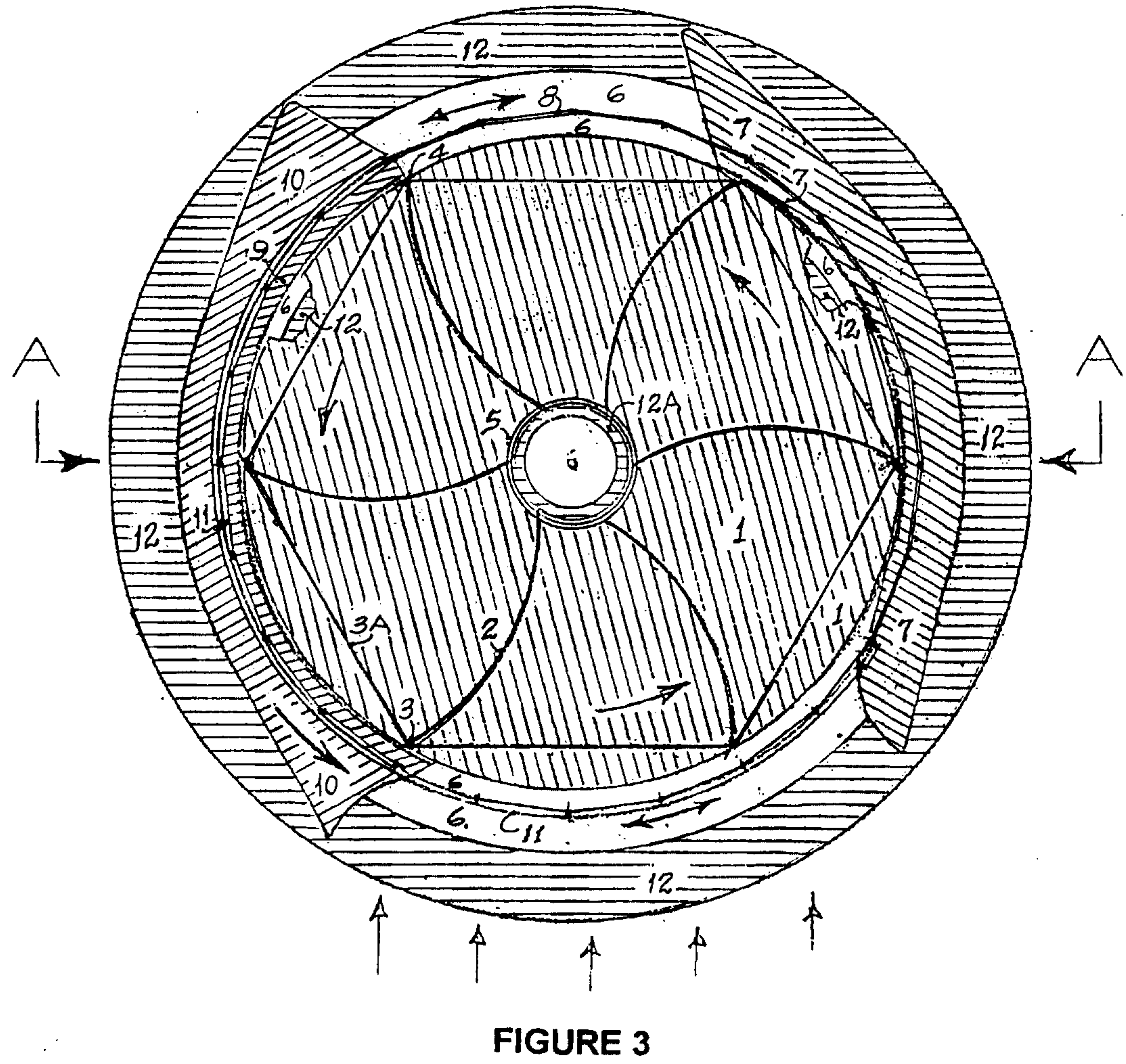
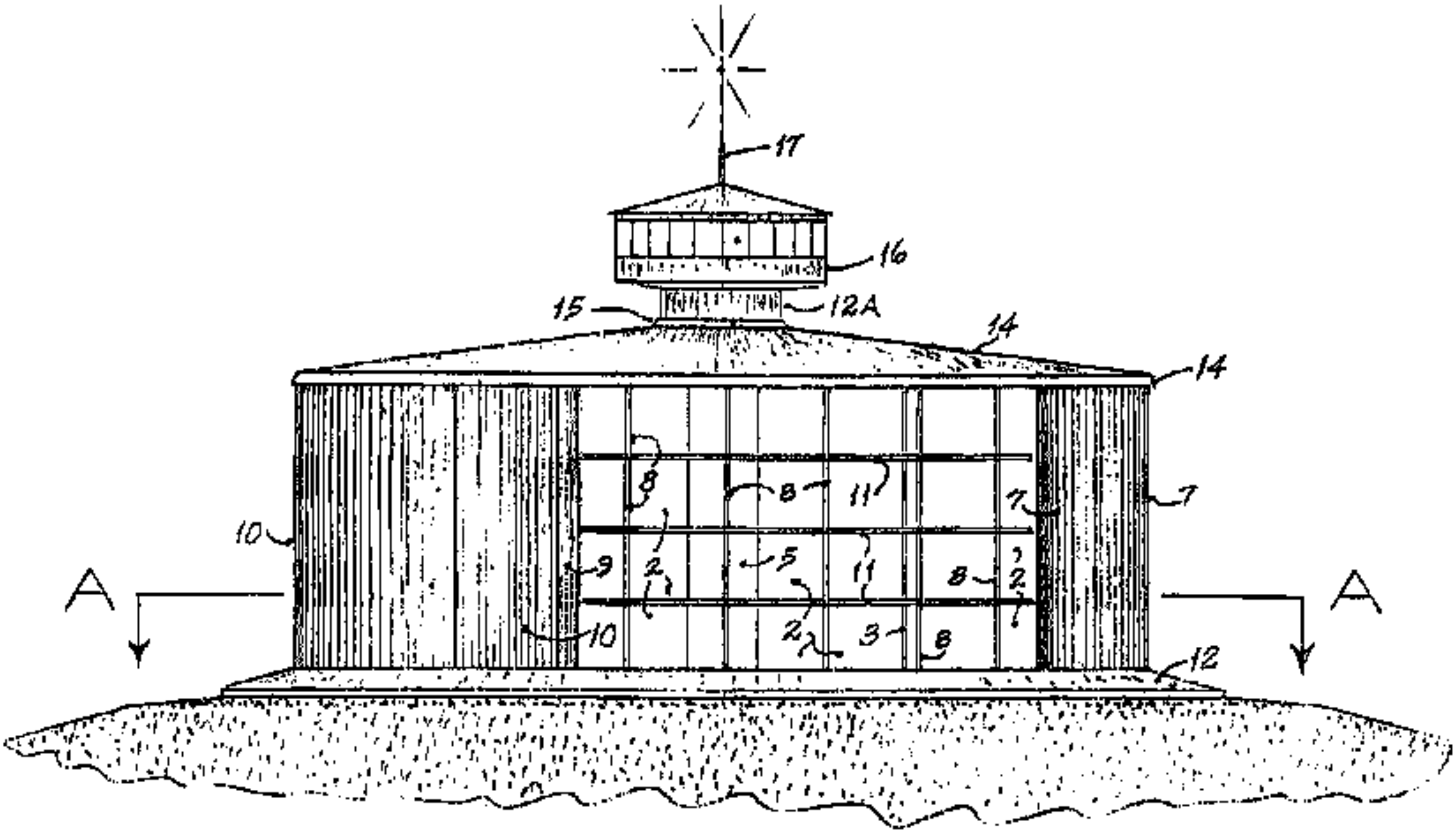


FIGURE 3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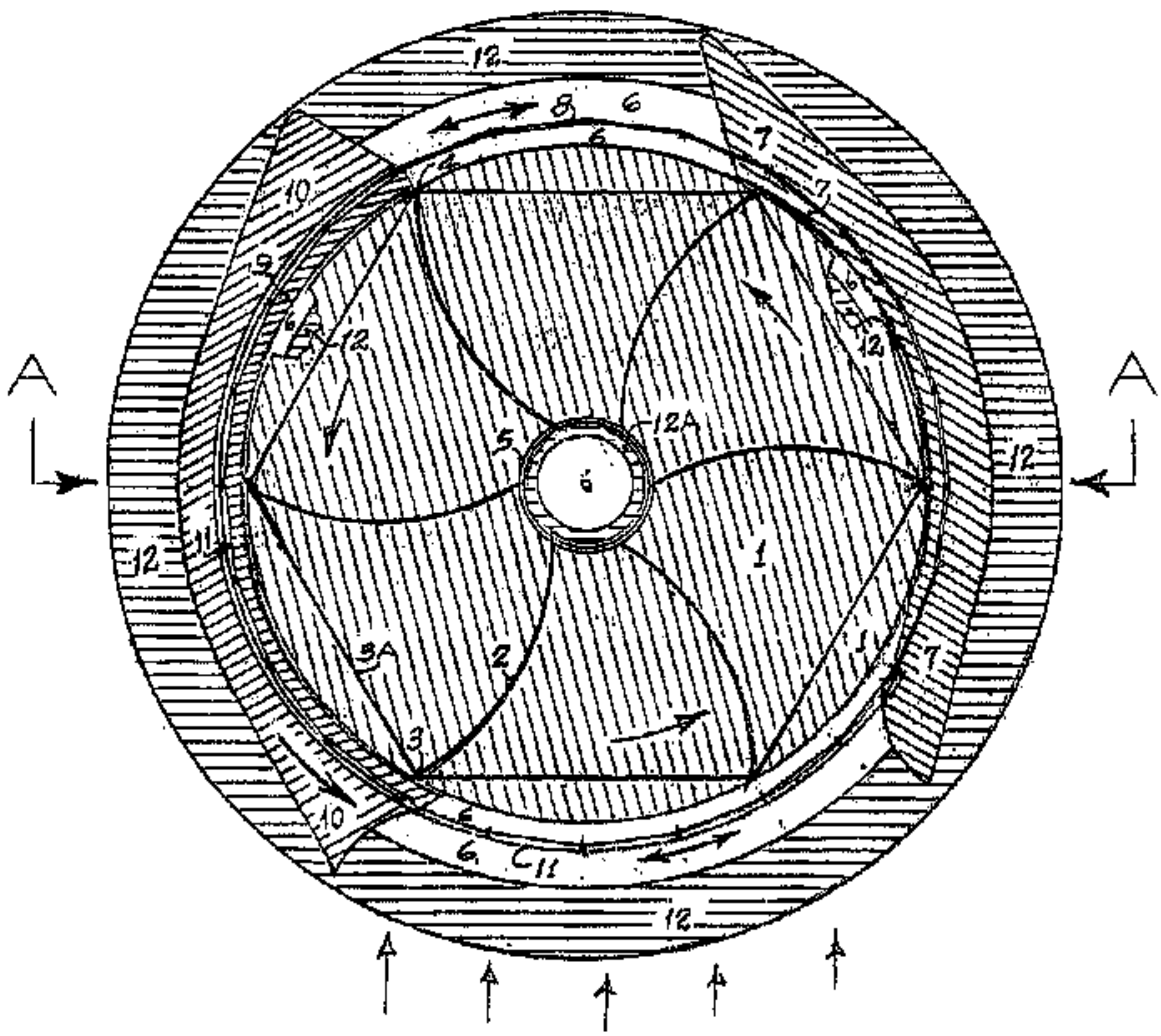
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