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WIND-DRIVEN POWER PLANT WITH CENTRIFUGAL GOVERNOR

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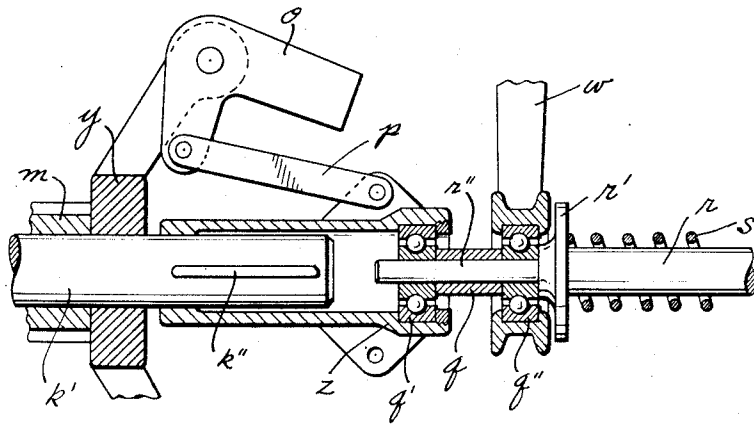
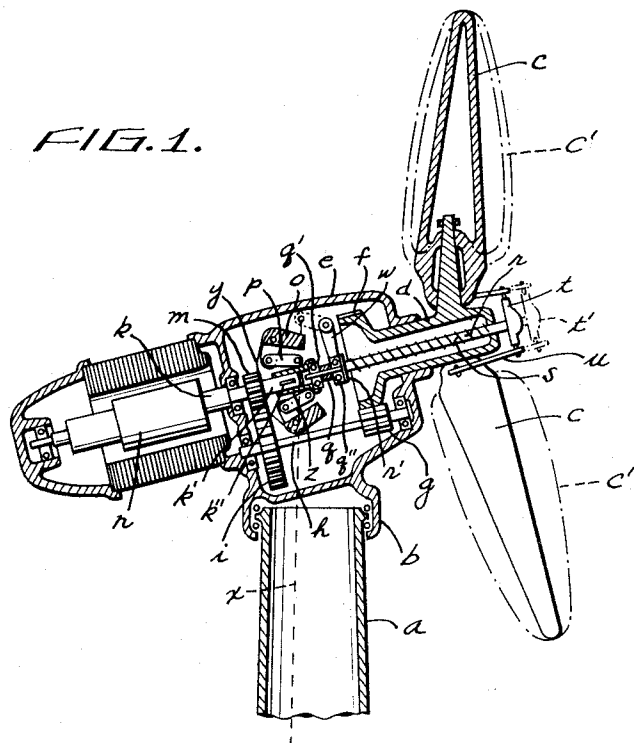


FIG. 2.

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WIND-DRIVEN POWER PLANT WITH
CENTRIFUGAL GOVERNOR

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The present invention relates to wind-driven power plants and particularly to an arrangement of a centrifugal governor within a wind driven power plant.

It is the object of the present invention to provide a simple and effective arrangement for adjusting the vanes of a wind-driven power plant by means of a centrifugal governor.

It is another object of the present invention to arrange a centrifugal governor within the casing of a transmission connecting the vanes and the generator so that the governor mechanism is protected, lubricated, and heated by the friction of the transmission.

It is a further object of the present invention to provide an arrangement in which the centrifugal governor is mounted on the shaft of the generator so that it is rotated at high speed and operates with great force although being relatively small.

It is a still further object of the present invention to provide a wind-driven power plant in which the vane means, the generator, and the centrifugal governor are arranged coaxially so that only a simple structure is required.

With these and other objects in view which will become apparent from the following description I provide a wind driven power plant, comprising in combination, an elongated casing, vane means arranged on one end of the elongated casing rotatably mounted thereon, the vane means including adjustable vanes, electric generator means mounted on the other end of the casing, a transmission arranged in the casing and operatively connecting the vane means and the electric generator means for driving the latter at a rotary speed different from the rotary speed of said vane means, rotatable centrifugal governor means arranged in the casing in the space between the vane means and the electric generator means and driven by one of the means, and adjusting means arranged in the casing and operatively connecting the centrifugal governor means and the adjustable vanes for adjusting the position of the vanes in accordance with the variations of the speed of rotation of the governor means.

In the known devices centrifugal governors of all types have been employed to adjust the vanes in accordance with the speed of rotation. However, a great number of elements had to be provided between the centrifugal governor and the vanes. This complicated structure causes not only higher frictional losses, but is also subject to frequent disturbances.

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The present invention overcomes these drawbacks by arranging a centrifugal governor coaxially with the axis of rotation of the vane means and of the generator. Between the vane means and the generator a transmission is arranged, whose shaft is parallel to the axis of rotation of the generator and spaced therefrom. The centrifugal governor is mounted directly on the shaft of the generator and rotates at a high speed so that the adjusting mechanism operates with great force although the dimensions of the governor are relatively small.

The centrifugal governor is arranged in the gear casing so that it rotates while being automatically and continuously lubricated by the oil contained in the casing, while being at the same time protected from moisture and any outer damaging or disturbing influence. At the same time the governor is protected from cold and cannot freeze in cold weather since the frictional losses cause heating of the oil in the gear casing. On account of the arrangement of the centrifugal governor between the generator and the vane means only few elements are required for actuating the adjusting mechanism of the vanes, and frictional losses are thereby kept at a minimum. These elements are small, require very little space, and are protected by the casing from the influence of the weather, while being lubricated and heated by the oil contained in the casing.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a preferred embodiment of the invention; and

Fig. 2 is a longitudinal sectional view of a detail of the embodiment shown in Fig. 1, on a larger scale.

Referring now to Figs. 1 and 2 of the drawings the power plant is rotatably mounted on a mast by means of a ball-bearing *b*. The vanes *c* are mounted rotatably about their longitudinal axis for adjustment on projecting shafts of a tubular hub *d*. The tubular hub *d* is rotatably mounted in the casing *e* on its middle portion, while the portion projecting into the casing is flanged and provided with an external gear *f*. External gear *f* is meshing with a pinion *g* fixedly mounted on one end of a shaft *h* which is rotatably mounted

in the casing. On the other end of shaft *h* a further gear *i* is mounted meshing with and driving a pinion *m* which is mounted on a portion of the generator shaft *k* projecting into the gear casing *e*. The rotor of the generator *n* is mounted on shaft *k*.

The generator shaft *k* is provided with a shaft extension *k'* extending beyond the pinion *m*, on which the governor is mounted. This governor comprises a carrier *y* rigidly fastened to said shaft extension *k'* and abutting with its rear end against the front side of the pinion *m*, and in addition a sleeve member *z* attached to the shaft extension by means of a key *k''* in such a manner that it rotates at the same speed as the shaft *k*, but may slide a certain distance in axial direction. Pivotaly connected to the carrier *y* are centrifugal weights *o* of bell-crank shape which move outwardly as the speed increases. Levers *p* are pivotaly connected to the end of one arm of the centrifugal weights *o* and to the sleeve member *z* in such a manner that swinging of the centrifugal weights *o* around their fulcrum causes the levers *p* to move the sleeve member *z* in axial direction towards the vanes. The outer race of bearing member *q'* is rigidly fixed to the sleeve member *z* while the inner races of the ball bearings *q'*, *q''* and the annular member *q* are fixedly secured to the reduced end portion *r''* of an actuating rod *r*.

The other end of the actuating rod *r* is mounted in the front portion of the hollow hub *d*. Arranged on said actuating rod is a spring *s*, which bears with its front end against the inside of hub *d* and with its rear end against a collar *r'* provided at the back end of the large diameter portion of the actuating rod *r* with the result that spring *s* forces the actuating rod *r* together with annular member *q*, bearing members *q'*, *q''*, and sleeve *z* in rearward direction against the action of the governor.

On the other end portion of the actuating rod *r*, the adjusting member *t* is mounted which turns the vanes *c* into the desired position by means of rods *u* pivotaly connected on one end to the vanes *c* and on the other end to the adjusting member *t*.

The arrangement of governor and actuating rod is designed as described above, because the pinion *m*, shaft extension *k'*, carrier *y*, sleeve *z*, the outer race of bearing member *q'* and the governor rotate at generator speed while actuating rod *r* and the inner race of the bearing member *q'* turn at the speed of the wind driven wheel.

The drawing shows the vanes *c* in operating position. The broken lines *c'* show the vanes in inoperative position.

In a preferred embodiment the wind-driven power plant is provided with a manually operated device for stopping the rotation of the vanes by turning them into an inoperative position. A lever *w* is pivotaly mounted in the casing and the vanes *c* are put into inoperative position when by means of the manually operated rope *x* the lever *w* is turned and exerts pressure on the outer race of the bearing member *q'* to shift the actuating rod *r*.

The drawing clearly shows that the centrifugal governor and the elements connecting the governor with the vanes are arranged in the casing and protected against disturbing influences from the outside.

The rotor of the generator, the centrifugal governor, the actuating rod and the vane means are arranged coaxially, and not only the transmission, but also the actuating elements are arranged

within the gear casing and, consequently, kept warm and lubricated. A minimum space is required so that the efficiency of the apparatus is not impaired.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of wind driven power plants differing from the types described above.

While the invention has been illustrated and described as embodied in a wind driven power plant with a centrifugal governor arranged in its gear casing, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A wind-driven power plant, comprising in combination, an elongated casing; rotary vane means arranged on one end of said elongated casing rotatably mounted thereon, said vane means including adjustable vanes; rotary electric generator means mounted on said casing; a transmission arranged in said casing and connecting said vane means and said electric generator means for driving said electric generator means at a rotary speed higher than the rotary speed of said vane means; rotatable centrifugal governor means arranged in said casing and driven by said electric generator means; and adjusting means operatively connecting said centrifugal governor means and said adjustable vanes for adjusting the position of said vanes in accordance with the variations of the speed of rotation of said governor means.

2. A wind-driven power plant, comprising in combination, an elongated casing; rotary vane means arranged on one end of said elongated casing rotatably mounted thereon, said vane means including adjustable vanes; rotary electric generator means mounted on said casing coaxially with said vane means; a transmission arranged in said casing and connecting said vane means and said electric generator means for driving said electric generator means at a rotary speed higher than the rotary speed of said vane means; rotatable centrifugal governor means arranged in said casing coaxially with said vane means and said electric generator means in the space between said vane means and said electric generator means and driven by said electric generator means at said higher rotary speed; and adjusting means arranged in said casing and operatively connecting said centrifugal governor means and said adjustable vanes for adjusting the position of said vanes in accordance with the variations of the speed of rotation of said governor means.

3. A wind-driven power plant, comprising in combination, an elongated casing; rotary vane means arranged on one end of said elongated cas-

ing rotatably mounted thereon, said vane means including adjustable vanes; rotary electric generator means mounted on the other end of said casing coaxially with said vane means, said electric generator means including a shaft projecting into said casing; a transmission arranged in said casing and connecting said vane means and said electric generator means for driving said electric generator means at a rotary speed higher than the rotary speed of said vane means; rotatable centrifugal governor means arranged in said casing in the space between said vane means and said electric generator means fixedly mounted on said shaft of said electric generator means and driven thereby at said higher rotary speed; and adjusting means arranged in said casing and operatively connecting said centrifugal governor means and said adjustable vanes for adjusting the position of said vanes in accordance with the variations of the speed of rotation of said governor means.

4. A wind-driven power plant, comprising in combination, an elongated casing; vane means arranged on one end of said elongated casing rotatably mounted thereon, said vane means including adjustable vanes; electric generator means mounted on the other end of said casing coaxially with said vane means, said electric generator means including a shaft projecting into said casing; a transmission arranged in said casing and operatively connecting said vane means and said electric generator means, said transmission including a first gear fixedly connected to and coaxial with said vane means, a second gear fixedly mounted on said shaft of said electric generator means, and gear means operatively connecting said first and said second gear and arranged parallel to and spaced from the axis of rotation of said vane means and said electric generator means; rotatable centrifugal governor means arranged in said casing in the space between said first and said second gear and being fixedly mounted on said shaft of said electric generator means and driven thereby; and adjusting means arranged in said casing and operatively connecting said centrifugal governor means and said adjustable vanes for adjusting the position of said vanes in accordance with the variations of the speed of rotation of said governor means.

5. A wind-driven power plant, comprising in combination, an elongated casing; a tubular hub rotatably mounted on said casing and having an inner end portion extending into said casing and an outer end portion projecting out of said casing; at least two shafts on said outer end portion; at least two adjustable vanes rotatably mounted on said shafts; electric generator means mounted on the other end of said casing coaxially with said vane means, said electric generator means including a shaft projecting into said casing; a transmission arranged in said casing and operatively connecting said tubular hub and said electric generator means, said transmission including a first external gear on said inner end portion of said tubular hub, a second gear fixedly mounted on said shaft of said electric generator means, and gear means operatively connecting said first and said second gear and arranged parallel to and spaced from the axis of rotation of said tubular hub and said electric generator means; rotatable centrifugal governor means arranged in said casing in the space

between said inner end portion of said hub and said second gear, and being mounted on said shaft of said electric generator means and driven thereby; an actuating rod arranged in the axis of said tubular hub and projecting out of it through a central hole in the outer end portion of said tubular hub, said actuating rod being operatively connected to said centrifugal governor means for axial movement; and adjusting means operatively connecting said actuating rod and said adjustable vanes for rotating said vanes about said shafts on the outer end portion of said tubular hub when said actuating rod is axially displaced by said centrifugal governor means.

6. A wind-driven power plant, comprising in combination, an elongated casing; a tubular hub rotatably mounted on said casing and having an inner end portion extending into said casing and an outer end portion projecting out of said casing; at least two shafts on said outer end portion; at least two adjustable vanes rotatably mounted on said shafts; electric generator means mounted on the other end of said casing coaxially with said vane means, said electric generator means including a shaft projecting into said casing; a transmission arranged in said casing and operatively connecting said tubular hub and said electric generator means, said transmission including a first external gear on said inner end portion of said tubular hub, a second gear fixedly mounted on said shaft of said electric generator means, and gear means operatively connecting said first and said second gear and arranged parallel to and spaced from the axis of rotation of said tubular hub and said electric generator means; rotatable centrifugal governor means arranged in said casing in the space between said inner end portion of said hub and said second gear, and being mounted on said shaft of said electric generator means and driven thereby; an actuating rod arranged in the axis of said tubular hub and projecting out of it through a central hole in the outer end portion of said tubular hub, said actuating rod being operatively connected to said centrifugal governor means for axial movement; adjusting means operatively connecting said actuating rod and said adjustable vanes for rotating said vanes about said shafts on the outer end portion of said tubular hub when said actuating rod is axially displaced by said centrifugal governor means; and manually operated means operatively connected to said actuating rod for axially displacing the same in order to turn said adjustable vanes into an inoperative position.

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