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N E W Z E A L A N D .

C o m p l e t e S p e c i f i c a t i o n .

"IMPROVEMENTS IN WIND-MILLS" .

I, Cornelius Murnane, of 259, Mt. Alexander Road, Ascot Vale, in the State of Victoria, Commonwealth of Australia, Agricultural Machinist, formerly of 30, Queensberry Street, North Melbourne, in the said State, do hereby declare the nature of my invention for

"IMPROVEMENTS IN WIND-MILLS" ,

and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement : -

This invention provides new and useful improvements in and connected with windmills, and it has been devised with the following objects in view, viz. to provide :- Firstly, a direct central crank-driven rocking arm, which gives a slow powerful movement on the working stroke of the pump and a quick movement on its return or "idle" stroke. Secondly, an improved means for automatically varying the length of the pump stroke in accordance with the changing power of the wind. Thirdly, a ratchet gear for converting the rotary motion of the wind wheel action into a reciprocatory motion and imparting the same to the pump rod. Fourthly, an improved wind wheel, which although very light and comparatively simple in construction, will be specially durable and effective.

In carrying out the invention the mill-body is made preferably in the form of a circular open framing and constructed in two parts. The lower part is affixed to the top of the tower, whilst the upper part is mounted and is free to rotate on ball or other antifrictional bearings arranged between the adjacent facings of the two parts of the said framing.

The wind wheel is supported on a shaft which is suitably affixed to the mill-body and out of the centre thereof. Formed integral with or affixed to the inside of the hub of the wind wheel is a pinion which is adapted to gear with a wheel fitted to a crank-shaft positioned in alignment with that of the wind-mill and supported on outwardly projecting brackets on the top part of the mill-body.

The crank on the latter shaft operates in a slot in the outer end of a rocking arm, which is pivotted about its centre in bearings on the mill-body, parallel with the crank-shaft bearings. The inner end of the rocking arm extends directly over the open centre of the

mill-body, and upon it is located a slidable pump-rod connection fitted with oppositely arranged pawls and a lifter for operating the same. These pawls engage with ratchet teeth formed in the top of the rocking arm, and are for the purpose of retaining the sliding connection at any point thereon. The pawl-lifter is connected to the slotted end of the rocking arm by means of a strong spiral spring which is arranged to act in opposition to a swinging lever mounted on the mill-body. This swinging lever is also connected to the pawl-lifter and is actuated by an adjustable wind-sail which is retained parallel with the wind-wheel. The slidable pump-rod connection moves either inwardly or outwardly as the power of the spiral spring or the wind-sail on the swinging lever predominates. Consequently the length of stroke of the pump rod is varied according to the change in the velocity of the wind.

The wind wheel I have devised and prefer to use for operating my mill is constructed essentially of an outer ring or frame to the inner periphery of which the enlarged ends of the vanes are secured at even distances apart. The inner ends of the vanes are attached by means of a screw and nut connection to an inner ring secured concentric with and near the hub of the wheel.

The invention and sundry modifications devised for automatically retaining the maximum amount of efficiency from the power obtainable from a wind of any or varying velocity will, together with their constructional details, now be fully described with the aid of the accompanying illustrative drawings, in which the same characters of reference have been employed to designate like parts in all the views.

In these drawings FIGURE 1 is a front elevation of a mill-body constructed according to my invention

having portion of its appurtenant parts and the wind-wheel removed.

FIGURE 2 is a plan of Figure 1 with the swinging lever removed.

FIGURE 3 is a plan of portion of the mill-body and the means I have devised of attaching the governing sail thereto.

FIGURE 4 is a vertical section of the sliding pump rod connection and portion of the rocking arm on the dotted line I-I.Figure 2.

FIGURE 5 is a cross section of portion of the mill-body framing.

FIGURE 6 is a perspective view of a device for coupling the governing sail to the mill body and the swinging lever for operating the slidable pump connection.

FIGURE 7 is a view of the wind sail attached to the swinging lever shewn in Figure 6.

FIGURE 8 is a rear elevation of the rocking arm illustrated in Figure 1.

FIGURE 9 is a view illustrating a modification of the means I have devised for imparting motion to the rocking arm from the wind wheel shaft.

FIGURES 10 and 11 are elevation and central cross section views, respectively, of part of the modification illustrated in Figure 9.

FIGURE 12 is a sectional view of part of Figure 11 on the dotted line II---II.

FIGURES 13 and 14 are elevation and central cross section views, respectively, of parts which may be substituted for the modification illustrated in Figures 10 and 11.

FIGURE 15 is a side elevation of a modified form of rocking arm and slidable pump rod connection.

FIGURE 16 is an end elevation of the slidable pump rod connection shown in Figure 15.

FIGURE 17 is a view similar to Figure 16 partly in section.

FIGURE 18 shows in plan part of the pump rod connection.

FIGURE 19 is an inverted sectional plan of the pump rod connection shown in Figures 15, 16 and 17 and taken on the dotted lines III-----III of the latter Figure.

FIGURE 20 is a side elevation of portion of the rocking arm showing the slidable pump rod connection in a locked position thereon.

FIGURE 21 is a view in plan illustrating further modifications in the construction of the rocking arm and the sliding pump rod connection.

FIGURE 22 is a side elevation of Figure 21 partly in section.

FIGURE 23 illustrates the wind wheel in front elevation.

FIGURE 24 is a side elevation of the wind wheel partly in section.

FIGURES 25 to 27 are views illustrating constructional details of the wind wheel.

The mill-body consists of an open circular framing formed in two parts which are designated in the drawings by the numerals 1 and 2. The lowermost part 2 fits within the upper part, and is provided with downwardly depending lugs 3 which are bolted or otherwise secured to the top of the tower 4.

The upper part 1 of the framing is formed at the top with an inwardly projecting flange 5 which is designed to rest upon ball bearings 6 carried in a race formed in the lower part 2. (See Figure 5 of the drawings). If preferred, any ordinary form of roller bearings may be substituted for the ball bearings 6. The upper part 1 of the framing is provided on its outer edge with a plurality of depending lugs or brackets 7 which are placed

at equal distances apart and adapted to carry rollers 8. These rollers 8 bear upon the underside of an outwardly projecting flange 9 on the lower part 2 of the mill-body framing (see Figure 5) and when affixed in position retain the two parts 1 and 2 thereof movably together. Thus it will be understood that the upper part 1 of the mill-body will readily rotate and yet be firmly secured to the lower part 2.

A shaft 10 is secured rigidly to the top of the upper part 1 of the mill-body and out of the centre therefof by means of clamping bolts 11 or in any other preferred manner. Portion of the said shaft 10 projects beyond the mill-body and carries the hub 12 of the wind-wheel 13 (see Figures 23 and 24). The inner end of the hub 12 is provided with a pinion 14 which may be either formed integrally therewith or rigidly secured thereto by any ordinary means.

This said pinion 14 engages with and operates a larger toothed gear wheel 15 (part only of which is shewn in the drawings) keyed securely to the outer end of a crank shaft 16

The crank shaft 16 is arranged parallel with the shaft 10 carrying the wind wheel 13, and is supported in bearings 17 on the outer end of brackets 18. These brackets are preferably formed integrally with, and project from, the upper part 1 of the mill-body at right angles to the wheel shaft 16.

The crank 19 of the shaft 16 is provided preferably with an antifrictional roller 20 and operates in the slotted or outer end of a rocking arm 21. This rocking arm 21 is preferably square in section, and is pivotted about its centre in bearing 22 located at the inner end of the brackets 18. The detachable top portions or covers 23 of the bearings 17 and 22 on each bracket 18 are preferably formed integral and are retained rigidly in position by bolts 24.

The slot 25 in the outer end of the rocking arm 21 is formed by casting or making a recess therein equal in length to the throw of the crank 19 and affixing to the top thereof a strip of metal 26. The inner end of the rocking arm 21 carries a slidably mounted pump-rod connection 27 having outwardly projecting studs or trunnions 28 to which the jaw 29 on the top end of the pump operating rod 30 is affixed. The pump-rod connection 27 is made in the form of a sleeve and slides freely on the rocking arm 21 and the operating rod 30 is connected to the pump by any ordinary means.

The inner end of the rocking arm 21 is formed with a series of holes (21^a) in which may be inserted a stop pin (21^b) to determine the extreme travel of the pump rod connection.

An opening 31 is cut longitudinally through the top of the pump rod connection and pivotted centrally therein is a pawl-lifter 32. This pawl-lifter 32 is pivotted about its centre, and is formed at its lower end with two short arms 33 which operate arms 34 on the pawls 35 pivoted in the longitudinal opening 31 of the slidable pump rod connection. The gripping ends of these pawls 35 face inwardly and engage with ratchet teeth 36 cut in the upper surface of the arm 21.

One end of a rod 37 is pivoted to the upper end of the pawl-lifter 32 and its opposite end has an outwardly projecting lug 38 which is slidably mounted on a prismatic rod 39. The said rod 37 curves downwardly at a point immediately behind the pawl-lifter until it is close to the rocking arm, where it is formed with a slot 40 which engages with a pin 41 passing transversely through the slidable pump-rod connection. The length of the slot 40 is such that it will enable the rod 37 to have sufficient longitudinal movement to operate the pawl-lifter 32 independently of the pump-rod connection 27.

The rear end of the prismatic rod 39 is supported in a rearward extension 42 of the strip of metal 26 which forms the top of the crank slot 25. The forward end of the said rod 39 is bent downward at right angles, and is secured to the shoulder of the trunnion or journal 43, where it carries a grooved roller 44.

A constant rearward pressure is exerted on the rod 37 by means of a strong tension spring 45, one end of which is secured to a forward part of the said rod and the other end to an adjustment screw 46 fitted in the rearward extension of the metal strip 26. The necessary adjustment of the screw 46 is obtained by the butterfly nut 47.

The rear end of the said rod 37 is provided with an upwardly projecting jaw 48 adapted to surround the spiral tension spring 45 which latter retains the former constantly in position on the rocking arm 21.

A flexible-connection as a rope 49 is secured at one end to the outwardly extending lug 38 on the rear end of the rod 37. It then passes round the grooved roller 44 and through the centre of the hollow trunnion or journal 43 before mentioned, to the upper end of the arm 50. This arm is rigidly affixed to a horizontal shaft 51 which is supported in two vertical angle-iron standards 52 secured by bolts 53 to lugs 54 formed on the upper part 1 of the mill-body, (see Figures 2, 3 and 6).

The opposite end of the shaft 51 is bent downwards at right angles, and secured by clamping bolts 56 to a vertical shaft 56. The said shaft 51 is retained in position in the standards 52 by an adjustable collar 57.

The said vertical shaft 56 is preferably hollow, and telescopically supports in its upper end a smaller rod 58 which is retained in any required position by the set screw 59.

The vertically adjustable rod 58 carries on its upper end a flat sail 60 (see Figures 1 and 7) which may be of any suitable size to give the required amount of leverage to operate the arm 50. The vertical shaft 56 may extend any convenient distance below the shaft 51, and is fitted preferably with a counter-balancing weight 61 which can be adjusted at any point thereon by means of a set screw 62 or other approved means. 63 is a stay connecting the top part 1 of the mill-body with one of the standards 52, and is designed to give additional rigidity to the latter.

In lieu of using the arm 50 and sail attachments to operate the flexible connection 49 and rod 37, an ordinary governor may be substituted.

The shaft of the said governor could be operated by any well known mechanical means from the wind wheel and the outer end of the flexible connection 49 be attached to a sliding sleeve on said shaft. The speed of the governor would vary according to that of the wind wheel, and the sliding sleeve and rod 37 be moved more or less as the speed and consequently the centrifugal force of the governor is increased or decreased.

64 indicates a governing sail, which is normally retained approximately at right angles with the wind wheel and is supported by both standards 52. The said sail 64 is formed by securing a sheet of corrugated or flat zinc 65 or other suitable material to a rectangular metal framing 66. The upper part 67 of this framing 66 extends inwardly from the said sail 64 and connects with an end of a long bar-link 68 which is pivotally supported by a bolt 70 at its opposite end in a jaw 69 formed on the top of the left hand standard 52.

One end of an adjustment rod 71 is secured pivotally to near the outer end of the said bar-link 68, by suitable means as a clamping piece 72. The opposite end of the adjustment rod 71 is screw-threaded, and passes through a hole in the top of the right hand standard 52, the adjustment of the said rod being effected by a nut 73.

The lower part 74 of the framing 66 extends inwardly and is formed at its end with a depending stud 75 which pivots in the lower end of the left hand standard 52 and is prevented from withdrawing therefrom by the pin 75^{a}.

The governing sail 64 is secured to the right hand standard 52 by a flexible connection 76 which is provided at any point in its length with a strong spiral spring 77. This connection 76 permits the governing sail 64 to be pulled out of the right angle only in one direction, and the spring absorbs all jar when it swings back to its normal position. Owing to the upper part 67 of the framing 66 being pivoted out of alignment with and nearer the sail 64 than the lower part 74 the outer end of the sail rises as it is drawn during its feathering motion to the right. The necessary motion is given to the governing sail in this direction either by means of a cord 78 which is attached to the framing 66 and from there passes around grooved pulleys 79 and 80 on the mill-body to the foot of the mill from which point it can be easily operated, or by an excessive wind velocity causing the wind-wheel to move out of its operative position.

The slidable pump-rod connection 27 can be rigidly secured at any desired point of the rocking arm 21 by means of the set screw 81 when it is required to drive the mill with a fixed pumping stroke.

In Figures 9 to 12, wherein I have illustrated modifications in the means employed for operating the rocking arm, the numeral 82 indicates the wind-wheel shaft, which is placed at right angles to the said rocking arm 21 and is rotatably mounted in a long bearing 83 located to the left of the centre of the mill-body. The hub of the wind-wheel is rigidly connected to the said shaft 82, which is provided on its inner end with a roller 84 and pinion 85.

The pinion 85 gears with an endless internally toothed rack 86 the ends of which are rounded and the sides segmental in form approximating a radius struck from the pivoted point of the rocking arm 21. The rack 86 is slidably mounted on parallel rods 89 formed integral with or rigidly secured to the rocking arm 21, by means of jaws 90 which project outwardly from the back of the guide plate 87. Two or more of these jaws 90 engage with each rod 89, and they are kept in constant engagement therewith by means of blocks 91 and a pin 92.

If a right hand motion be given to the pinion 85 when it is in engagement with the teeth on the outer side of the rack 86, the rocking arm 21 is raised until the pinion 85 is at the lower end of the rack. The pinion then commences to engage with the teeth on the inner side of the rack and causes the arm 21 to be moved downwardly.

The sliding pump-rod connection 27 and pawl-operating rod 37 are operated as hereinbefore described.

Figures 13 and 14 illustrate a modification in the rack and pinion device, which may be substituted for that shewn in Figures 9 and 10. This latter rack and pinion device has been designed in order to obtain a slow strong lift, and a quick return or downward motion of the pump-rod. To effect this varying or change motion, the guide plate 87 is formed with an inner and an outer internally toothed rack which are indicated by the numerals 93 and 94, respectively. The former rack 93 is located on the left hand side of the guide plate 87, whilst the rack 94 is located on the right hand side of the said plate. This said guide-plate 87 is given the same formation as that illustrated in Figure 10. An endless path 88 is formed in the guide-plate 87, and is adapted to receive the end of the wind-wheel shaft 95 which is fitted with an antifrictional roller 96. Keyed to the shaft 95 in juxtaposition to the roller 96 and in contiguity with each other, are two pinions 97 and 98. The former pinion 97, which engages with the rack 93 is considerably smaller and nearer to the antifrictional roller than the latter pinion 98 gearing with the rack 94.

These two pinions 97 and 98 may be cast or formed integrally or separately, as desired.

When a right hand motion is given to the wind-wheel shaft 95, and the guide-plate is in the relative position shown in Figure 13 of the drawings, the small pinion 97 operates in the outer and right hand rack 94 and slowly raises the said guide-plate and rocking arm 21 therewith. At the completion of the upward stroke of the rocking arm 21 and guide plate 87 the larger pinion 98 will have engaged with lower end of the inner and left hand rack 93, and in its further motion will cause the rack and rocking-arm to decend with greater rapidity than it was raised by the smaller pinion. The ratio of speed between the upward and downward movement of the arm 21 would of course be determined by the relative sizes of these two pinions 97 and 98, respectively.

In Figures 15 to 20 where I have shewn a modification of the means of automatically varying the length of the pump-rod stroke according as the velocity of the wind changes, 99 indicates an elongated split sleeve which is adapted to surround the inwardly projecting end of the rocking arm 21. This said end is made preferably circular or elliptic in cross section, and the split sleeve 99 carried thereon is made to correspond therewith. The inner end of the said sleeve 99 is provided with an upwardly projecting jaw or lug 100 to which is connected one end of the rod 37. The remaining portion of the said rod 37 is similar to and operates the same as that illustrated in Figures 1, 2 and 3. Projecting laterally from each side of the slidably mounted split sleeve 99 is a journal 101 which is designed to form a pivotal support for a cheek of a jaw 102 formed on the upper end of the pump connection rod 30. This said jaw 102 is of a peculiar design (See Figures 16 to 19) having each cheek formed with two inwardly converging projections 103 arranged opposite each other and one on each side thereof.

The projections 103 on each side of the said cheeks of the jaw 102 are adapted to bear against depending studs 104 formed one on each side of the longitudinal openings or "split" formed in the bottom of the sleeve 99. The outer faces of these said depending studs 104 incline oppositely and are adapted to conform to the lines formed by the projections 103 on their adjacent cheeks of the jaw 102. Thus, the adjacent faces of the depending studs 104 and the projections 103 in the jaw 99 bear evenly against each other whilst the rocking arm 21 is horizontal, and when in this position the sleeve is automatically moved along the said arm in either direction (according as the strength of the wind or the spring 45 predominates) to a position which will enable the pump operating rod 30 to have a maximum amount of lift from the strength of the wind then existing.

The consequent decrease in the angle formed by the arm 21 and the pump operating rod 30, when the former is moved upwardly or downwardly out of the horizontal, causes two oppositely positioned projections 100 in the jaw 102 of the latter to bear with considerable pressure against the contiguous face of the depending studs 104 on the split sleeve 99 and compress the same tightly on the rocking arm (see Figure 20). The jaw 102 may be made in two parts as shown and bolted to the operating pump-rod 30.

A further modification of the means I have devised for automatically altering the stroke of the pump operating rod 30 is illustrated in Figures 21 and 22. In this instance the rocking arm 21 is formed at about its centre with an upwardly extending jaw 105 in which are pivotted two pawls 106 and an intermediately located "pawl-lifter" 107 similar to that shown in Figures 1, 2 and 4. The pawl-lifter is pivotally connected by a link 108 to a lug 109 on the short arm of a bell crank 110. This said bell crank 110 is pivotted to the outer end of a bracket 111 projecting outwardly from and formed integral with a trunnion of the rocking arm.

The long arm of the said bell crank is fitted on its outer end with a rod 112 which passes through the centre of a journal of the before mentioned trunnion and connects at its opposite end with a suitable lever operated by the wind-sail 60.

Pivotted to the end of the short arm of the bell crank 110 is a rod 113 which extends outwardly and through a lateral projection on the top of the strip of metal 26 forming the top of the crank slot 25. The outer end of the said rod 113 is bent upwards, and attached thereto is one end of a spiral tension spring 114, the opposite end of which is connected to a lug 115 formed on a sleeve 116 slidably mounted on the inner end of the rocking arm 21. The said sleeve 116 is provided with lateral studs 117 to which are pivotted the cheeks of a jaw 118 on the upper end of the pump operating rod. 119 indicates a rack preferably formed integral with the slidable sleeve 117 and projecting rearwardly through and at the bottom of the jaw 105. The said rack 119 has the same motion as the slidable sleeve 116 and this latter is held in position by means of the pawls 106 engaging with the former. As the strength of the wind increases the long arm of the bell crank 110 is pushed inwards, and the short arm with its attached rod 113 and link 108 is moved forwardly, thereby increasing the tension on the spring 114 and moving the pawl-lifter 107 forwardly, respectively. When the above action has taken place, the various parts described will have assumed the positions shown in Figure 22, in which case the forward pawl 106 is disengaged from the rack 119 thereby enabling it and the attached sleeve 116 to move forwardly at the commencement of the "up stroke" of the pump operating rod 30.

The sleeve 116 and rack 119 continue to move forwardly until the tension of the spring 114 overcomes the strength of the wind, when the bell-crank 110 and its attached parts will be worked oppositely to the manner previously described.

and thus allow the forward pawl 106 to engage with the rack and prevent any further outward movement of the same. 120 is a set screw for rigidly affixing the sleeve 116 to the rocking arm 21 when it is desired to obtain a fixed stroke of the pump rod.

It will be understood that by the above mentioned device the pump operating rod will be given a long or short stroke automatically according as the strength of the wind increases or diminishes. The rocking arm 21 and its appurtenant parts may be used with almost any of the existing types of mills, when it would be located above the pump and operated by the existing crank or eccentric operating on the mill body.

The wind-wheel I have devised for operating the mill hereinbefore described is illustrated in Figures 23 and 24, wherein 12 indicates the hub and 13 the entire wheel.

Projecting radially from the hub 12 are four or more lugs 121 to which are bolted the inner ends of spokes 122 preferably formed of piping as shown. The outer ends of the spokes 122 are bent at right angles and bolted to a circumferential ring 123 which is designed to carry the outer ends of the vanes 124. These vanes 124 are connected to the circumferential ring 123 by means of elbow plates or brackets 125. The inner ends of the vanes 124 are provided with hook-bolts 126 which are adapted to pass through and be secured by nuts 127 to a smaller ring 128 bolted to the spokes 122.

The stems of the hook-bolts 126 are preferably provided each with two nuts 127, one on each side of the inner ring 128, which like the circumferential ring 123 is made preferably of channel sections as illustrated. The inner ring 128 is secured to the spokes 122 and concentrically with the circumferential ring 123 by means of hook-bolts 129 as shown in Figures 23 and 24.

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The ends of the vanes 124 are strengthened by folding them over stiffening pieces of metal 130 and providing holes in the same to receive hook-bolts 126 and bolts for fastening the elbow plates or brackets 125 in the inner and outer ends respectively.

The mode of operation with my invention is briefly described as follows :-

The action of the wind imparts a left hand motion to the wind wheel 13 and consequently to the pinion 14 on the hub 12 thereof, which pinion 14 in turn imparts a right hand motion to the spur wheel 15 and crank shaft 16. The crank 19 on the said shaft 16 in the outer half of its rotation bears downward on the outer end of the rocking arm 21 and gives a slow powerful leverage to raise the pump operating rod 30 connected to its inner end. The inner half of the rotation of the said crank 19 - owing to its operation being in a field adjacent to the pivotted portion of the rocking arm - raises the outer end of the said arm rapidly and consequently forces the pump operating rod 30 downwards with greater rapidity than it was raised by the outer half of the rotation of the said crank. When the wind has reached a velocity sufficient to turn the wind-wheel it will also actuate the sail 60 and force it backwards until the leverage of the attached arm 50, connected to the rod 37 by the flexible connection 49, is balanced by the spring 45. The outward movement of the sail 60 and the attached arm 50 causes the rod 37 to be moved towards the inner end of the rocking arm 21, and in its initial movement, or while it is traversing the space governed by the slot 40 and pin 41, this said rod 37 throws forward the "pawl-lifter" 32 which action disengages the inner pawl 35 from the ratchet teeth 36 in the arm 21 and enables the slidable pump rod connection 27 to be moved along the same until it is checked by the tension of the spring 45.

When the tension of the spring 45 balances the leverage of the arm 50 the pawl-lifter 32 assumes a vertical position thus allowing both pawls to engage with the ratchet teeth 36 and thereby retain the slidable pump rod connection 37 in a fixed position on the said rocking arm 21.

Should the velocity of the wind increase, the cycle of operations above described will be repeated and the load on the pump rod be increased accordingly.

Immediately the velocity of the wind diminishes the tension of the spring 45 predominates over the leverage of the arm 50 and therefore causes the rod 37 and slidable pump rod connection 27 to be moved inwards until the tension of the former and the leverage of the latter balance, when the said slidable connection will remain fixed until a sufficient variation of the wind occurs to enable the same to be again moved by one or the other of the actuating means described.

The initial movement of the rod 37 in its inward direction and during the space of travel determined by the slot 40 and the pin 41 causes the pawl-lifter 32 to be drawn inwards and thereby raise the outermost pawl 35 out of engagement with the teeth 36 on the arm 21, when the force of the spring 45 will continue to pull the rod and also the slidable pump-rod connection 27 inward until the strength of the wind is sufficient to balance the strength of the said spring.

The counter weight 61 is secured on the lower end of the vertical shaft 56 in such a position that it will readily return the wind sail 60 to its normal position as the strength of the wind diminishes.

Should the velocity of the wind increase to such an extent as to be more than sufficient to force the slidable pump rod connection 27 to the extreme outward position, and the load on the pump rod be then sufficient to steady the wind-wheel, this latter will feather out of the wind in the ordinary manner.

When the wind-wheel is feathering out of the wind it causes the governing-sail 64 to pivot on the inner ends of the upper and lower parts 67 and 74, respectively, of its framing and remain parallel with the wind. This feathering action of the wind-wheel partially rotates the top part of the mill body framing, and the outer end of the governing-sail rises as it swings round to keep in line with the wind, owing to the construction of the framing and the manner in which the same is pivotted to the mill body.

The said governing-sail and wind-wheel are retained in this position by the excessive velocity of the wind, and immediately the strength of wind moderates the governing-sail will gravitate or swing backwards and downwards until the flexible connection 76 is taut, and at the same time return the wind-wheel to its operative position.

The wind-wheel can be turned out of the wind as desired by pulling the cord 78 downwards, which action pulls the governing-sail round until it is almost parallel with the wind-wheel when the wind will turn the wind-wheel and the mill-body into an inoperative position.

The vanes of the wind-wheel may be given more or less "weather" by pivotting their respective fastening brackets and hooks, or one or the other of these said fastening means may be pivotted more than the other so as to obtain a variation of the amount of "weather" at the different ends, when required.

HAVING NOW PARTICULARLY DESCRIBED and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is :-

1. In a wind-mill, a framing formed in two parts one of which is affixed rigidly to the top of a tower and rotatably supports the second part, to which is secured the axle of the wind-wheel, a pinion on the wind wheel hub gearing with a wheel on a crank shaft operating a rocking arm having a slidably mounted pump-rod connection adapted to be moved inward or outward according as the strength of the wind decreases or increases, substantially as and for the purposes set forth.

2. In a wind-mill, a rotatably mounted framing having an axle rigidly affixed thereto carrying a wind-wheel, a pinion on the hub of said wheel adapted to gear with a wheel on a crank shaft which is supported in brackets on the framing, a pivotted rocking arm having a slotted end in which said crank operates and provided at its opposite end with a slidably mounted pump-rod connection, substantially as and for the purposes set forth.

3. In a wind mill, a rotatably mounted framing having a rocking arm pivotted thereto, a slot in the outer end of said arm adapted to receive an operating crank and a slidable pump-rod connection on its inner end, which is adapted to be moved inwards and outwards by the action of a spring and the pivotted arm of a wind-sail respectively, substantially as and for the purposes set forth.

4. In a wind mill, a pivotally mounted rocking arm provided with ratchet teeth on its inner end, a pump rod connection mounted slidably on said arm and provided with a pawl lifting device and oppositely arranged pawls which are adapted to engage with the said ratchet teeth of the rocking arm, substantially as and for the purposes set forth.

5. In a wind mill, the combination with the subject matter of the preceding claiming clause of a spring connected to the pump-rod connection and acting on the same in

opposition to a lever actuated by a wind sail and means for adjusting the tension of said spring and the leverage of the said wind-sail, substantially as and for the purposes set forth.

6. In a wind mill, a circular framing formed in two parts 1 and 2, ball or other antifrictional bearings between the said parts, rollers 8 and flange 9 for retaining the two parts rigidly together, brackets 18 and lugs 54, substantially as described and illustrated, and for the purposes set forth.

7. In a wind mill, the combination of an arm pivotted centrally to a bracket on the mill body and having a slotted outer end adapted to receive a crank for imparting a rocking motion to said arm, a sliding pump-rod connection on the inner end of the said arm provided with oppositely arranged pawls adapted to engage with ratchet teeth on the said arm and a pivotted lifting lever connected by means of a reciprocatingly mounted rod and a spring to the outer end of the arm, a flexible connection from the said rod to an arm which is designed to be actuated in opposition to the said spring, substantially as and for the purposes set forth.

8. In a wind mill, the combination with a framing formed in two parts, one of which is rotatably mounted on the other, of a governing sail constructed with two connecting arms, the lower of which is longer than the upper and pivots in a standard on the movable part of the framing, and the upper or shorter arm pivotted to a bar-link having its opposite end pivotted to the said framing, a rod connected pivotally at one end to the said bar-link and provided at its opposite end with adjustment means for altering the angle of the same, substantially as and for the purposes set forth.

9. In a wind mill, the combination with a framing formed in two parts, one of which is rotatably mounted on the other, of the parts indicated by the numerals 64 to 80 arranged and operating substantially as described and illustrated in Figures 1, 2, 3 and 6 of the drawings, and for the purposes set forth.

10. In a wind mill, a framing formed in two parts one of which is rotatably mounted on the other, the wind wheel axle being supported rotatably on the movable part and having a pinion affixed rigidly to its inner end operating an endless internal rack secured movably to a pivotted rocking arm to which is slidably mounted a pump rod connection, substantially as and for the purposes set forth.

11. In a wind mill, a rotatable framing having a bearing in which is rotatably mounted an axle of a wind wheel, a roller on the inner end of said axle adapted to run in an endless path cut in a plate parallel with an internal endless rack which engages with a pinion affixed to the said axle adjacent the said roller and means for slidable connecting the said rack to a rocking arm designed to impart a reciprocatory motion to a rod, substantially as and for the purposes set forth.

12. In a wind mill, the combination with the subject matter of the preceding claiming clause 11, of a pump rod connection slidably mounted on the rocking arm and provided with oppositely arranged pawls adapted to engage with ratchet teeth on the said arm and a pivotted lifting lever connected by a reciprocatingly mounted rod and spring to the outer end of the arm, a flexible connection from the said rod to an arm designed to be actuated in opposition to the said spring, substantially as and for the purposes set forth.

13. In a wind mill, the combination, and arrangement of the parts indicated by numerals 21 to 60 in Figures 1 and 2 and the numerals 82 to 92 in Figures 9 to 12 of the accompanying drawings, substantially as described and for the purposes herein set forth.

14. In a wind mill, the combination with a rocking arm secured pivotally to a movable framing, of guide rods arranged parallel therewith to which is slidably affixed a plate having an endless pathway cut therein and curved internal racks formed thereon, a wind wheel axle supported in bearings on the movable framing at right angles to the rocking arm and provided on its inner end with a roller and pinions which engage with the said pathway and racks respectively on the said plate, substantially as described and illustrated in the accompanying drawings and for the purposes herein set forth.

15. In a wind mill, a rotatably mounted shaft affixed to a movable framing at right angles to a rocking arm pivotted thereon, a curved plate slidably mounted on rods parallel with the rocking arm and having an endless pathway cut therein and furnished on each of its sides with a rack, a roller on the end of the said shaft adapted to travel in the pathway in said plate and pinions of different sizes on the said shaft, the smaller or inner pinion being adjacent to the said roller and adapted to gear with the outer rack on the upward stroke and the larger pinion with the inner rack on the downward stroke, substantially as described and illustrated, and for the purposes herein specified.

16. In a wind mill, a rocking arm 21 having parallel rods 89, a plate 87 mounted slidably on said rods, an outer rack 93 and inner rack 94 adapted to gear with pinions 97 and 98 respectively on a wind wheel axle 95, a roller 96

on the inner end of said shaft engaging with a pathway 88 cut in said plate, substantially as described and illustrated in Figures 13 and 14 of the drawings and for the purposes herein set forth.

17. In a wind mill, the combination of a rocking arm actuated from the wind wheel and having a sliding pump rod connection, comprising a split sleeve mounted thereon, depending studs on the said sleeve having their outer faces oppositely inclined and adapted to bear against bevelled projections on the insides of a jaw secured to the pump operating rod and journals on the said sleeve for connecting the jaws thereto, substantially as described and for the purposes set forth.

18. In a wind mill, the combination with the subject matter of the preceding claiming clause 17 of a jaw 100 on the said sliding sleeve, a rod 37 connected thereto and rod 39, spring 45, adjustment screw 46 and nut 47, substantially as described and illustrated in Figure 15 of the accompanying drawings, and for the purposes herein specified.

19. In a wind mill, the combination with a movable framing of a centrally pivotted rocking arm having an upwardly extending jaw in which are pivotted oppositely arranged pawls adapted to engage with a rack on a sliding pump rod connection mounted on the inner end of the arm, a lifting lever pivotted in the centre of said jaw and means as a bell crank, link and rod for connecting the lifting lever to an arm operated by a wind sail, a spring and rod connecting the bell crank and sliding pump rod connection, substantially as described and illustrated, and for the purposes herein set forth.

20. In a wind mill, the combination of parts indicated by the numerals 21 to 26 and 105 to 120 operating as and for the purposes described and as illustrated in Figures 21 and 22 of the accompanying drawings.

21. In a wind mill, a wind wheel having a number of lugs projecting radially from the hub thereof to which are affixed arms or spokes, a circumferential ring secured to the outer ends of said spokes and connected to an inner concentric ring by means of adjustably secured radial vanes, said inner ring also being affixed to the arm or spokes, substantially as and for the purposes set forth.

22. In a wind mill, a wind wheel having a plurality of lugs 121 projecting radially from the hub 12 thereof and affixed to which are the inner ends of spokes 122, a circumferential ring 123 on the outer ends of said spokes and an inner ring 123 secured to the spokes by bolts 129 concentrically therewith, vanes 124 connected radially and adjustably between the said rings by means of hook bolts 126 on their ends and brackets 125 on their outer ends, substantially as described and illustrated, and for the purposes herein specified.

DATED this 17th. day of November 1908.

Anthony J. Gallivan

Agent for Applicant.

To/ The Registrar of Patents,
Wellington, New Zealand.

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3 Sheets.
Sheet 1.

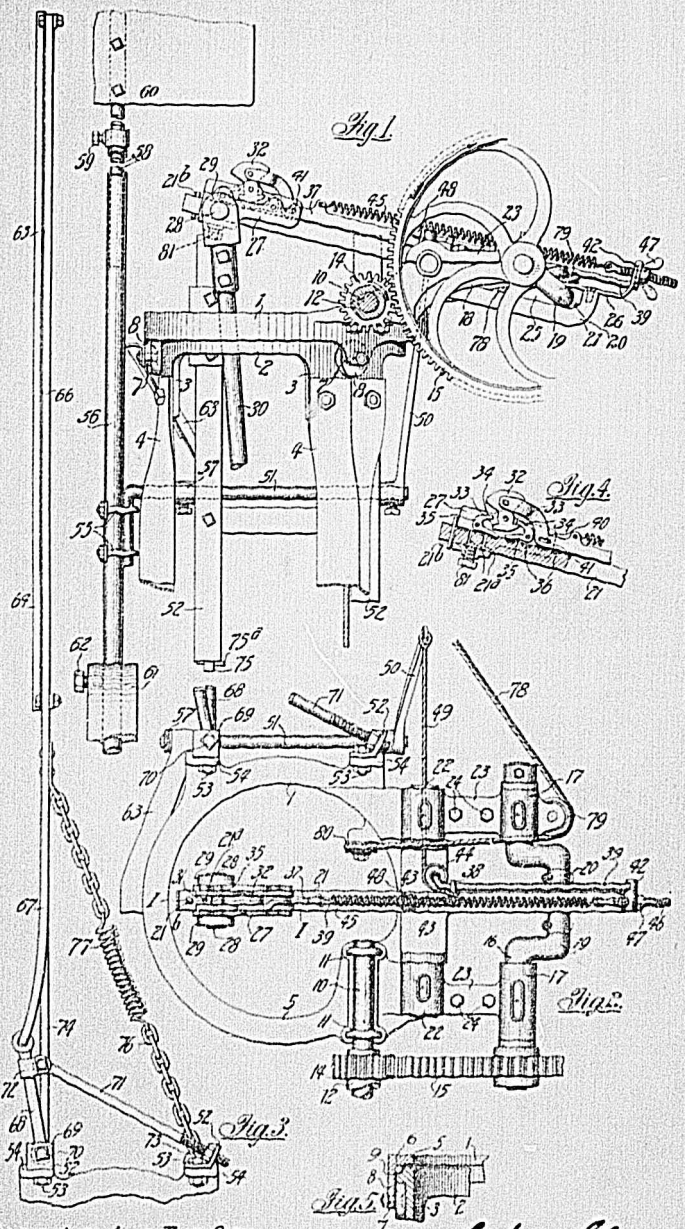


Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

Fig. 5.

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Sheet. 2.

Fig. 6.

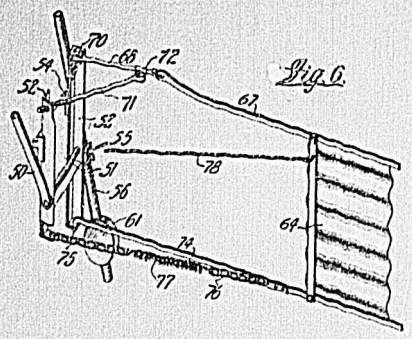


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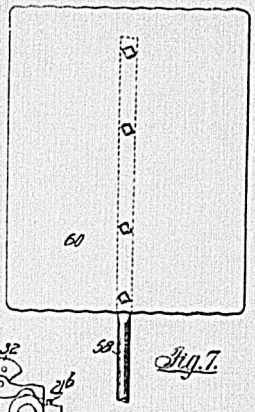


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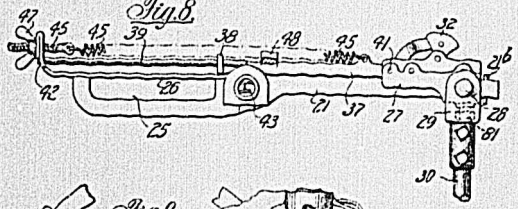


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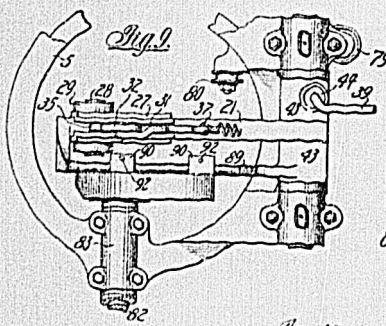


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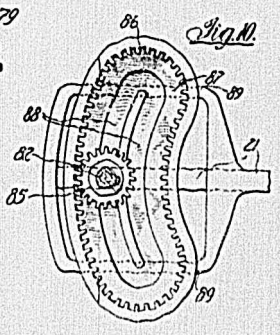


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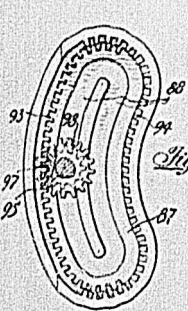


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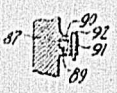


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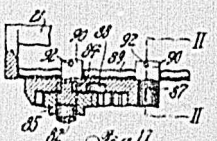
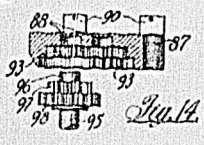


Fig. 14.



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Fig. 15.

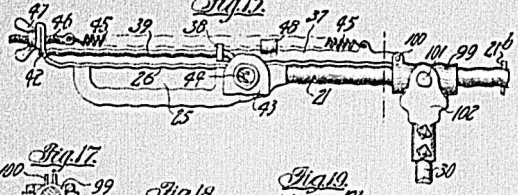


Fig. 16.



Fig. 17.



Fig. 18.



Fig. 19.

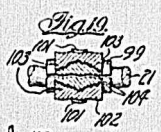
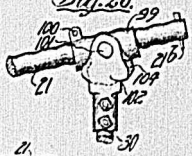


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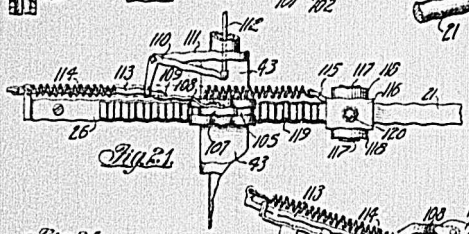


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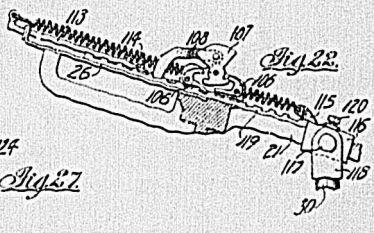


Fig. 22.

Fig. 23.

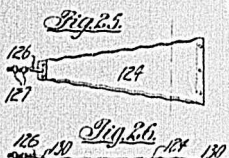


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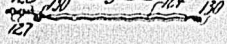


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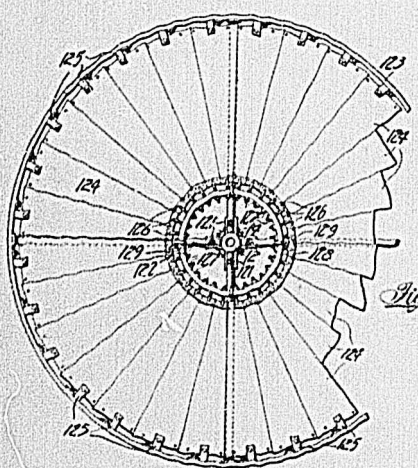


Fig. 25.



Fig. 24.

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