(No Model.) 2 Sheets—Sheet 1.

S. K. HUMPHREY.

WINDMILL.

No. 531,038. Patented Dec. 18, 1894.

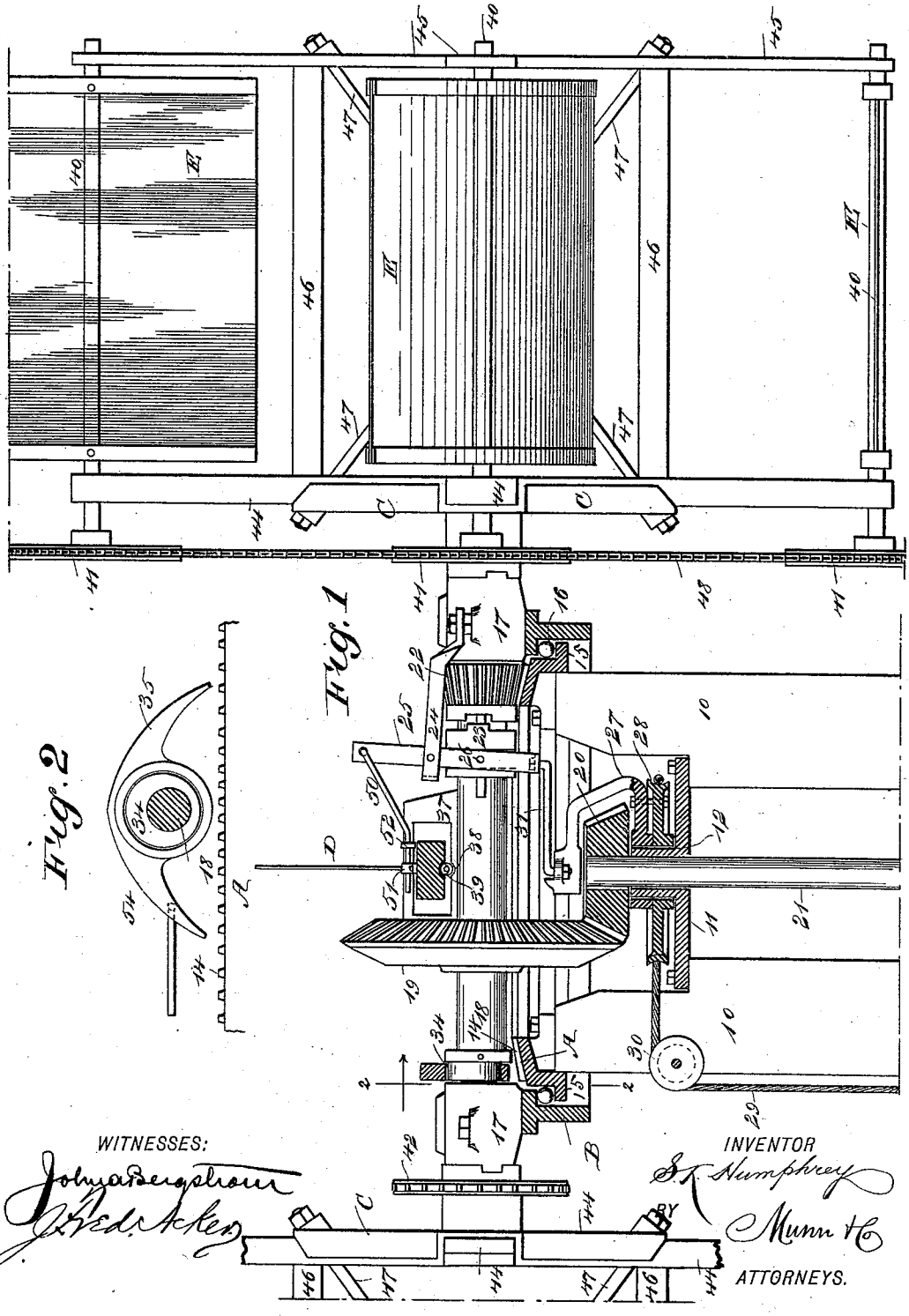

Fig. 1

Fig. 2

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Fig. 4

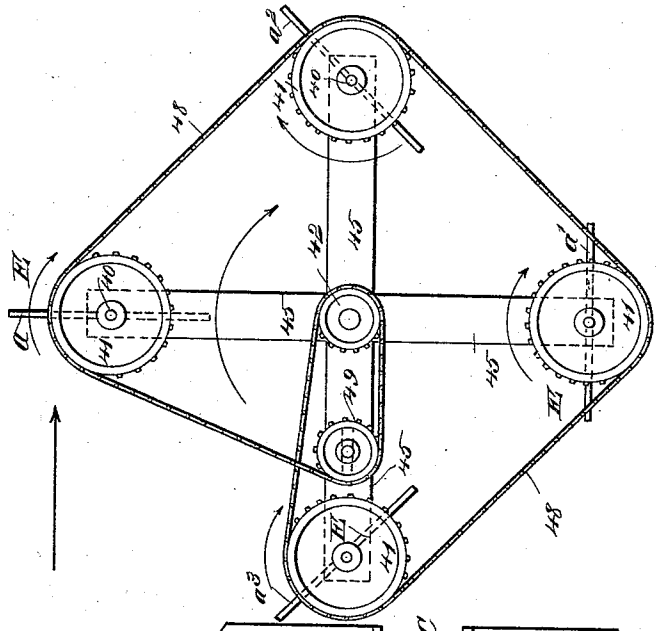
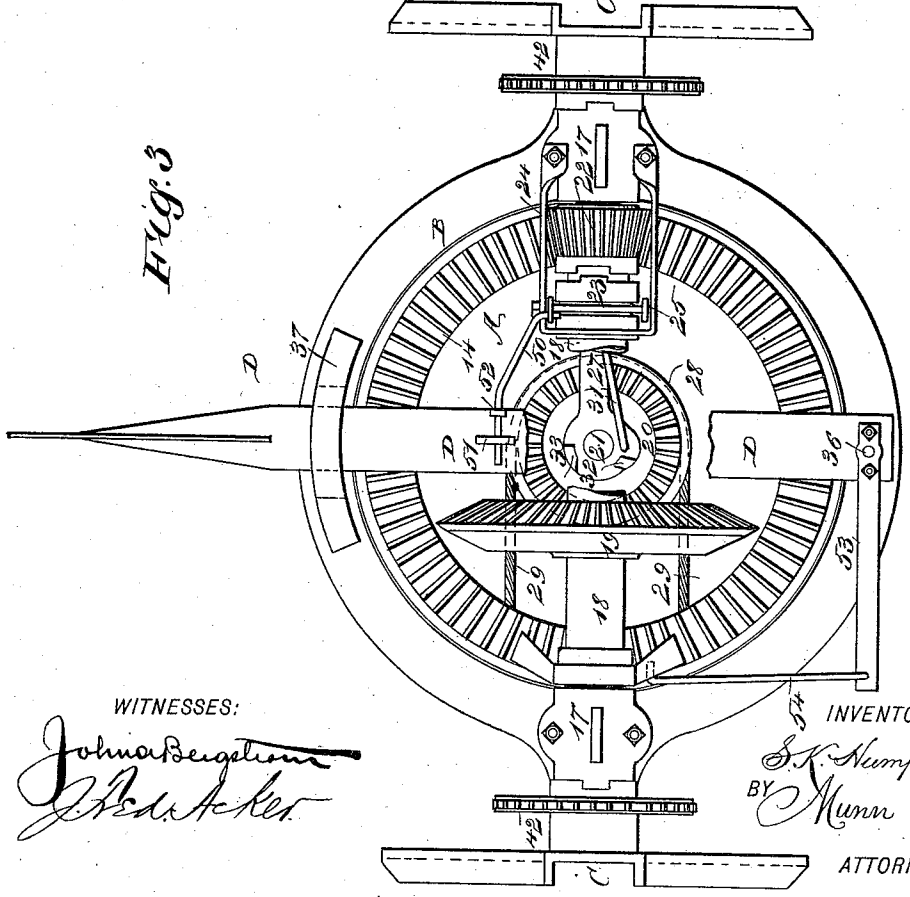


Fig. 3



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UNITED STATES PATENT OFFICE.

SETH K. HUMPHREY, OF OMAHA, NEBRASKA.

WINDMILL.

SPECIFICATION forming part of Letters Patent No. 531,038, dated December 18, 1894.

Application filed July 10, 1894. Serial No. 517,042. (No model.)

To all whom it may concern:

Be it known that I, SETH K. HUMPHREY, of Omaha, in the county of Douglas and State of Nebraska, have invented a new and useful Improvement in Windmills, of which the following is a full, clear, and exact description.

My invention relates to an improvement in wind mills of that type carrying sails, and the object of this invention is to employ a horizontal shaft carrying horizontally supported sails, and to provide a means whereby through the medium of a chain belt a group of sails may be made to operate in such a manner as to cause the various sails to shift their position. For example, when the upper sail is in the wind the opposite and lower sail will be out of the wind, or edge thereto, and when four sails are in a group the position of the two other sails will be at angles to each other and at opposite angles to the wind.

Another object of the invention is to provide a means whereby when the mill is thrown out of gear, the carriage will be made to operate upon the stationary section of the mill, carrying the mill around edge-wise to the wind, and furthermore to provide a means whereby should the wind shift, the carriage will automatically act upon the said stationary portion of the mill to bring the sails up into the wind.

A further object of the invention is to provide a support for the sails, adapted for attachment to the main driving shaft of the mill, which support will be exceedingly simple, durable and economic in its construction, and thoroughly braced.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a vertical section through the wind m ll, one set of sails being shown in side elevation. Fig. 2 is a section taken essentially on the line 2—2 of Fig. 1, illustrating the double-acting dog employed to assist in the automatic shifting of the mill. Fig. 3 is a plan view of the main portion of the mill, the main drive shaft being broken away to show the parts beneath it; and Fig. 4 is a diagrammatic view of a group of sails, the sails being shown in end elevation.

In carrying out the invention, the tower consists of any desired number of uprights 10, recessed at their upper inner sides to receive a platform 11 provided with an upwardly extending collar 12. An annular frame A, having a large central opening, the frame being substantially of a ring-like construction, is bolted or otherwise secured upon the top of the uprights of the tower, the said frame having its upper surface inclined and provided with series of teeth 14, whereby said upper surface is in the nature of a beveled gear. The frame A is likewise provided with an outwardly-extending flange 15 at its lower edge, and upon this frame a carriage frame B, likewise of circular or ring-like construction, is removably supported, the carriage frame being made to rest upon friction rollers 16, balls or their equivalents, held to turn upon the flange of the tower frame A, as shown in Fig. 1, whereby the carriage frame is capable of a horizontal, circular ball-bearing movement.

Boxes 17, are erected upon opposite sides of the carriage frame B, journaling a horizontal shaft 18, which shaft carries at each end a four-armed spider C, the said spiders being adapted to carry the framework in which the sails of the mill are located, as will be hereinafter described, and as is shown in Fig. 1. Although the spider is illustrated as having but four arms as supports for four sails, any number of arms or sails may be employed.

A large beveled gear 19 is secured upon the horizontal shaft 18, and this large gear meshes with a beveled pinion 20, located upon the upper end of the shaft 21, the latter shaft being adapted to transmit power to a pump or other object. A pinion 22, turns loosely upon the shaft 18, and said pinion rides in mesh with the teeth 14 of the upper surface of the tower frame A. The pinion 22, is provided with a clutch face adapted to engage with the clutch 23 sliding on a feather produced on the shaft 18 and turning with

the shaft. This clutch is operated from the vane or fan D, and the shifting mechanism is as follows:

A horizontal stirrup 24 is secured to the bolt heads of one of the boxes 17, and in the horizontal stirrup near its inner end a vertical stirrup 25, is pivoted, and the stirrup 25 extends both above and below the horizontal stirrup 24, and is provided with a stud or studs 26, entering a peripheral groove in the clutch 23, whereby upon the movement of the vertical stirrup the clutch will be made to slide either inward or outward upon the horizontal driving shaft 18. A bracket 27, is held to revolve upon the sleeve of the tower platform or plate 11. This bracket is placed astride of the pinion 20 of the perpendicular shaft 21, the upper end of the bracket being held to turn freely upon the upper end of the said shaft, which is carried above the pinion. The perpendicular shaft is journaled near its upper end by the sleeve of the said tower plate 11, and upon this sleeve, below the bracket, a grooved wheel 28 is held to turn freely, the said wheel being bolted or otherwise secured to the bracket 27 whereby they move together, and the wheel 28, is operated preferably by an endless cable 29, passing around it and leading to the ground over the guide pulley 30 placed in the tower.

A rod 31, is eccentrically pivoted to the top of the bracket 27, and it is likewise attached to the lower end of the vertical stirrup 25; and the said upper surface of the bracket is provided, as shown in Fig. 3, with two lugs 32 and 33, which prevent the bracket and the wheel 28 from turning more than a half revolution, as the lugs 32 and 33 will alternately come in contact with the connecting rod 31.

An eccentric 34, is firmly attached to the drive shaft 18 just inside of the box 17 opposite that near which the clutch is located, and the said eccentric is made to carry a double dog 35, shown in detail in Fig. 2 and in plan view in Fig. 3, the dog being adapted for engagement with the teeth upon the tower frame A. The vane or tail piece D, is located at right angles to the driving shaft 18, and is best shown in Fig. 3, the vane being pivoted at what may be termed its inner end to the carriage B, the pivot point being designated as 36. The vane swings horizontally, as is also shown in Fig. 3, to a limited degree in a strap or stirrup 37, located upon what may be termed the rear of the carriage, and the said stirrup or strap is provided with a depression 38 in the center of its lower wall, which lower wall is virtually a track and receives a guide roller 39, pivoted upon the bottom of the vane, as shown in Fig. 1, and the said roller when resting in the cavity 38 of the stirrup will prevent the vane from wabbling from side to side.

With reference to the sails, usually four are located at each end of the driving shaft 18, and the said sails may be made either of cloth or of sheet iron, or of equivalent material, being attached firmly through their centers each to a shaft 40, and each shaft carries at its outer end a sprocket wheel 41, as shown in Fig. 4, which sprocket wheels on both sets of sails are in line with sprocket pinions 42, one preferably near each box and attached thereto, whereby said pinions are virtually fixed or stationary portions of the carriage, the shaft 18 turning loosely in them.

One of the main features of this invention, in addition to the driving of the same, is the construction of the frame work by means of which the sails are held in place. This construction is shown clearly at the right in Fig. 1, in which it will be observed that a beam 44 is secured in each arm of the spiders C, and that corresponding cross beams 45 are placed in front of the said inner beams 44, the outer and inner sets of beams being connected by cross bars 46, and truss rods 47, extending diagonally from the outer frame of beams 45 through the inner frame of beams and through the arms of the spiders, being provided with suitable nuts whereby said rods may be placed under tension. Four of these truss rods are employed, but two only are shown in the drawings. This form of frame admits of considerable extension and consequently very large sails may be carried. At the same time the frame is exceedingly simple, durable and light. The shafts 40 carrying the sails are journaled in the ends of correspondingly located inner and outer beams 44 and 45.

Fig. 4 illustrates the operation of the sails. The upper sail a is in a perpendicular position, and at the same time the lower sail a' stands horizontally, and the side sails A^2 and A^3 stand at angles of forty-five degrees, their upper ends pointing outwardly or in reverse directions. A continuous chain 48, is used in connection with each set of sails, being passed around the fixed sprocket pinions 42 and around the sprocket wheels 41, serving to turn the sails, being attached to the shaft upon which the sails are secured. The sprocket pinion 42 of each set of sails has preferably one-half the number of teeth of the sprocket wheels controlling the sails. An idler 49, likewise receives the chain 48, carrying said chain out from the sprocket pinion 42, the said idler being adjustably secured to one of the outer beams of a sail carrying frame in order that it may be shifted and keep the chain tight. The wind coming from either direction strikes the top sail a squarely and gives it a forward motion. The sails a^2 and a^3 also take the wind at an angle which impels them forward. If the wind is coming from the right-hand side, the sail a^2 is carried upward and the sail a^3 downward, the sail a', at this time approaching the wind edgewise. It will be seen that as the shaft is turned, each sail as it reaches the upper point will be perpendicular to the wind, and horizontal to the wind when it reaches the lower point, or that now shown occupied by the sail a', and that three of these sails are continually

performing work in causing the shaft 18 to revolve.

When the shifting mechanism controlling the clutch is operated the vane is likewise moved, this being accomplished through the medium of a connecting bar 50, pivotally attached to the upper end of the vertical stirrup 25 of the shifting mechanism, the said shifting rod being likewise adapted to slide in a keeper 51, located upon the body portion of the vane; and said connecting bar 50, is provided with a collar 52 secured thereon, which when the connecting rod is moved in one direction will strike against the keeper 51 and cause the vane to move in the direction of impact.

The operation is substantially as follows: In Figs. 1 and 3, the shifting wheel 28, forming a portion of the shifting mechanism is illustrated as turned half way. When the mill is in operation, the right-hand stretch of the rope or chain 29 should be pulled so as to turn the shifting bracket 27 about one-fourth of a revolution farther to the right, and thus draw the swinging or pivoted stirrup 25 and the clutch 23 away from the clutch surface of the loose pinion 22. The wind strikes the upper sails and gives the top of the shaft 18 a motion from the observer, the observer being supposed to look in the same direction that the wind is blowing. The motion of the shaft 18 is then imparted to the upright shaft 21 through the gearing 19 and 20. When the wind shifts, the vane D is blown to one side or to the other, and imparts motion to a lever arm 53, located at the forward end of the vane, which lever arm at its outer extremity carries a rod 54, which in its turn is pivoted to the double dog 35 swinging loosely on the eccentric 34. The dog can engage the cogs or teeth on the upper face of the tower frame on one side only at one time. The point where the connecting rod 54 is pivoted to the dog is below the center of the eccentric 34. Therefore, if the wind strikes the vane from the left the connecting rod 54 forces the front end of the dog into the cogs or teeth 14, and as the shaft 18 revolves, the eccentric 34 will crowd against the dog and force the carriage around the space of one tooth. This is repeated as long as the wind continues to hold the vane to the left. If the wind strikes the vane on the right side it imparts a forward motion to the connecting rod 54, which in turn raises the front of the dog 35 out of the teeth or cogs 14, and forces the rear end of the dog into the cogs, and the carriage B is impelled forward one tooth at each revolution of the shaft 18.

In order to throw the mill out of the wind, the left-hand strap of the shifting rope 29 is pulled so as to give the shifting wheel 28 and shifting bracket 27 a half revolution to the left. This forces the clutch 23 into the clutch face of the pinion 22. The upper end of the stirrup 25 will at the same time be carried in direction of the vane, and the collar 52 on the connecting rod will be brought in engagement with the keeper on the vane. Thus it will be observed that as the clutch is forced into the pinion to drive the same, the connecting rod 50 will at the same time move the vane or tail of the wind mill so that it will remain at right-angles to the shaft 18, and while in that position it holds both ends of the dog out of mesh with the cog in which it works. The revolution of the shaft 18 before the wind will then turn the pinion 22 with it, and will carry the carriage around as long as there is a pressure of wind on the sails. After one-fourth of the revolution of the carriage, the shaft 18 and all of the sails will be edgewise to the wind, and as the wind changes the sails will revolve the shaft 18, which in turn carries the carriage with it, and will keep the sails continually feathered to the wind.

In order to throw the mill into gear, the right-hand stretch of the rope 29 is drawn upon, and the shifting wheel 28 given one-half of a revolution. This draws the clutch 23 from the pinion 22, and the connecting rod 50 also withdraws from contact with the vane. The vane at that time being directly facing the wind, it will turn the carriage of itself part way round, and as soon as it does the wind gets action on the wind mill sails, and the dog 35, which is actuated by the vane, completes the squaring of the wind-mill carriage, face to the wind.

I am aware that in wind mills of this class vertical shafts have been operated by the sails, the sails being held in horizontal arms, and that the sprocket wheels of the sails are all in a horizontal plane, and the central wheel instead of being fixed to the carriage is fixed to the guiding vane, and the pressure of the wind on that vane has consequently to hold the central wheel firmly enough to operate the chains and sails. Under such a construction a wind mill is in practice substantially worthless, and this construction may be said to be the cause of failure of this class of wind mills; whereas, in the wind mill herein described, I employ a horizontal shaft with sprocket wheels in a vertical plane, and the central wheel is firmly fixed or stationary, and none of the wheels will have to depend upon the shifting wind for their position, as no matter whether the mill is directly facing the wind or not, the upper sails will always be squarely perpendicular and the lower sails horizontal.

Another important feature of this mill consists in the employment of the pinion 22 as a driver for the carriage, since this pinion is employed to carry the wind mill around edgewise to the wind when not in use, and maintains the sails continually edgewise to a shifting wind, thus preventing any possibility of undue pressure against the sails in a storm. The instant a slight pressure is made on one side of the sails the shaft 18 will turn and bring all the sails edgewise to the wind at once. This pinion virtually converts the wind

mill into a vane which is automatically placed edgewise to the wind.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a wind mill, a carriage, a driving shaft carried thereby, sails connected with the driving shaft, a fixed gear located upon the carriage, and stationary with respect to the sails and driving shaft and an endless belt engaging with said gear and having driving connection with the sails, whereby the upper sail will be perpendicular, the lower one horizontal and the side sails at an angle to a perpendicular line, their upper ends inclining in opposite directions, substantially as set forth.

2. In a windmill, a horizontal driving shaft, a frame carried thereby, sails located in the said frame, wheels operating said sails and located in a vertical plane, a central fixed wheel, stationary with respect to the driving shaft and sail frame and an endless belt passing over the fixed wheel and over the wheels of the sails, substantially as shown and described.

3. In a wind mill, the combination, with a carriage, a driving shaft carried thereby, and a sprocket wheel located upon the carriage, of a frame attached to the driving shaft, sails journaled in the said frame, sprocket wheels attached to the trunnions of the sails, an idler located adjacent to the fixed wheel, and an endless chain engaging all of the sprocket wheels of the sail and passed over the fixed wheel and idler, substantially as shown and described, whereby the position of the upper and lower sails will be at right angles to each other, and the position of the side sails at an angle of about forty-five degrees, their upper ends facing in opposite directions, as set forth.

4. In a wind mill, the combination, with a drive shaft and a spider secured thereto, of a frame consisting of an inner section attached to the spider, and an outer section, cross bars connecting the two sections, and truss rods diagonally connecting said sections of the frame and located between the cross bars, substantially as shown and described, the said frame being adapted for the carrying of sails, as specified.

5. In a wind mill, the combination, with a tower, and a frame secured upon said tower, having a cogged upper surface, of a carriage held to turn upon said frame, a driving shaft held to revolve in the carriage and provided with wind wheels, and an eccentric at one point in its length, a double dog loosely mounted upon the eccentric and controlled thereby, the dog being adapted for engagement with the cogged surface of the carriage, a vane pivoted upon the carriage, and a connection between the vane and the dog, whereby the former operates to throw one or the other point of the latter in engagement with the cogs of the carriage, as and for the purpose specified.

6. In a wind mill, a cogged platform, a carriage held to revolve around the platform, a driving shaft journaled upon said carriage, a pinion loosely mounted upon the shaft and engaging with the cogs of the said platform, a clutch carried by the shaft and adapted for driving connection with the pinion, a shifting mechanism, substantially as shown and described, connected with said clutch, a vane pivoted upon the carriage, and a connection between the shifting mechanism and the said vane whereby they operate together, as and for the purpose set forth.

SETH K. HUMPHREY.

Witnesses:
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M. W. PATRICK.