(No Model.) 3 Sheets—Sheet 1.

A. J. MARTIN.

CHANGEABLE SPEED GEARING.

No. 364,530. Patented June 7, 1887.

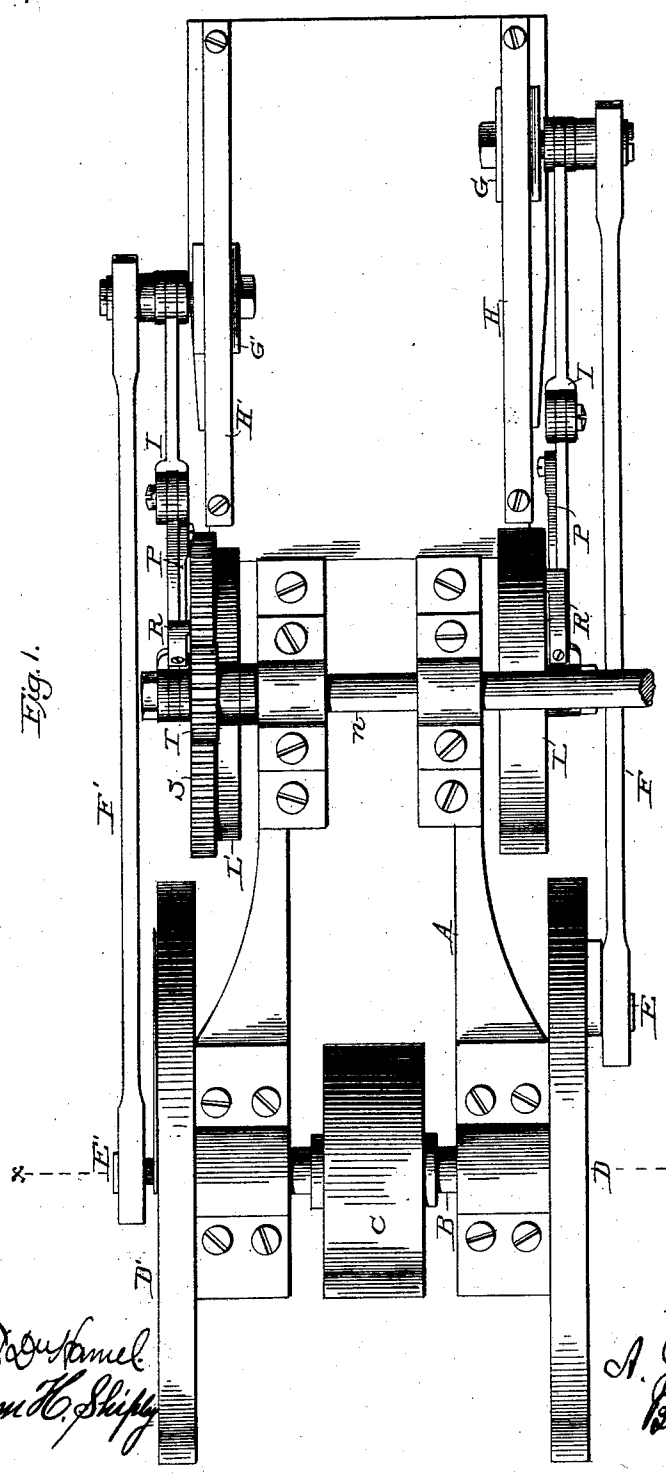

Fig. 1.

Attest:
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(No Model.) 3 Sheets—Sheet 2.

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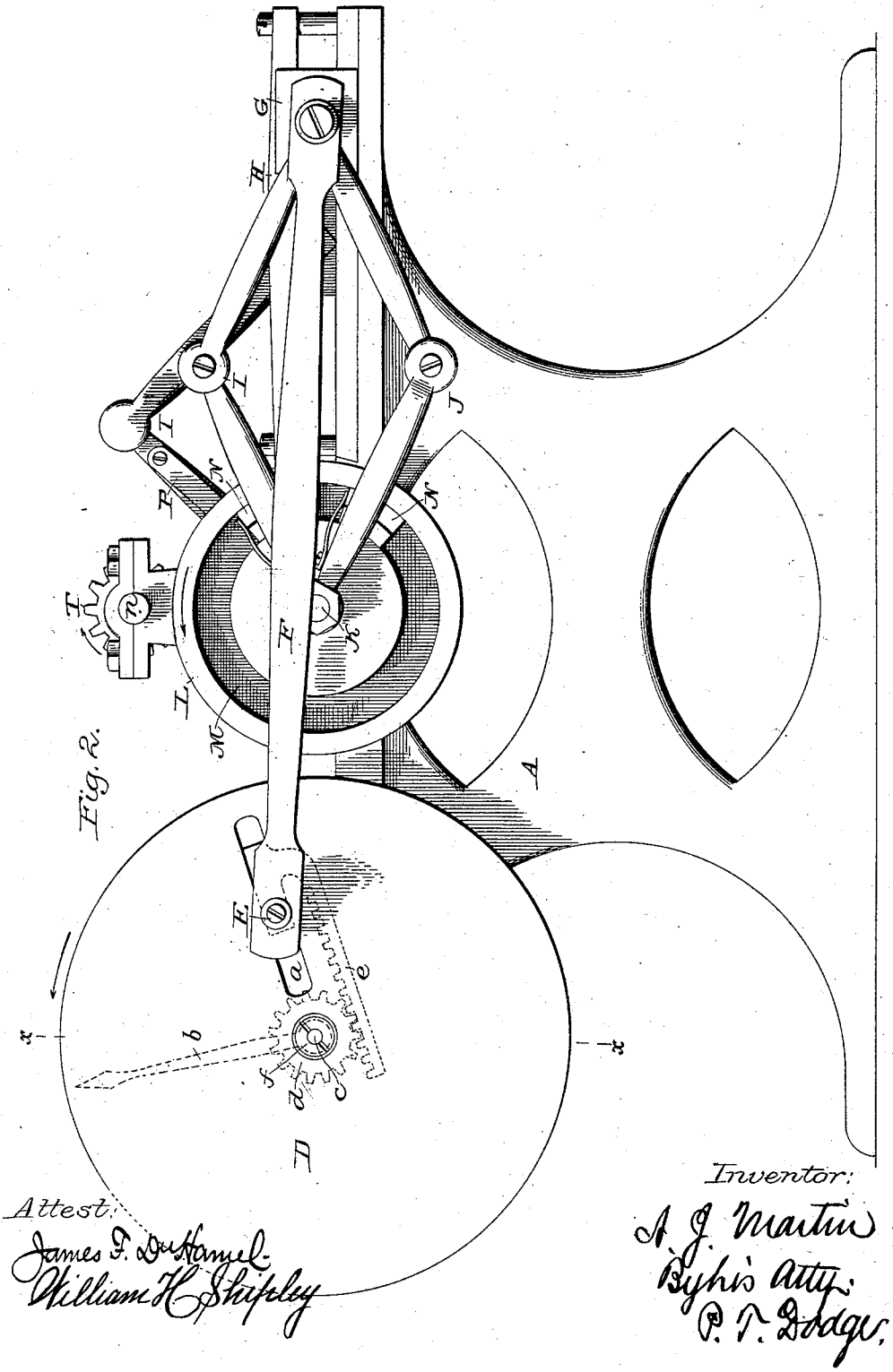

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

A. J. MARTIN.

CHANGEABLE SPEED GEARING.

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Fig. 3.

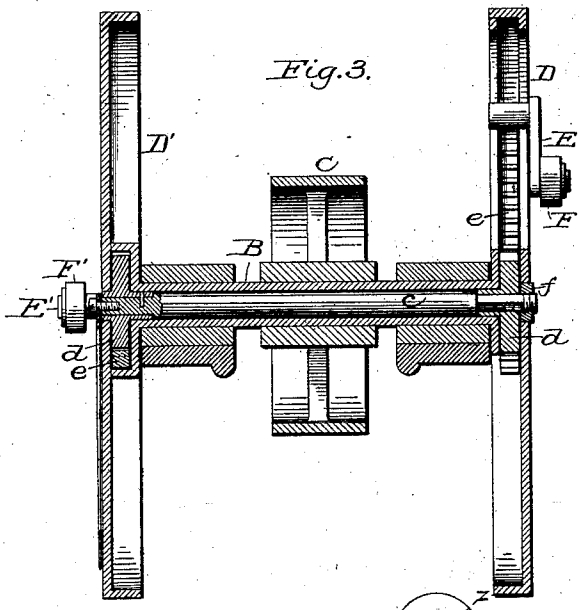


Fig. 5.

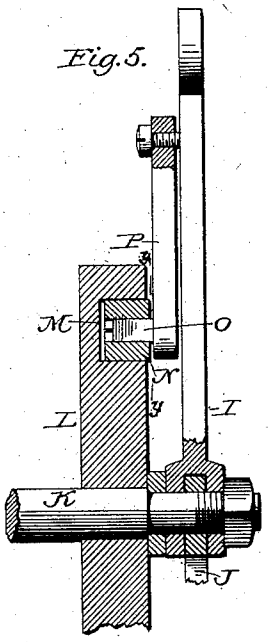


Fig. 4.

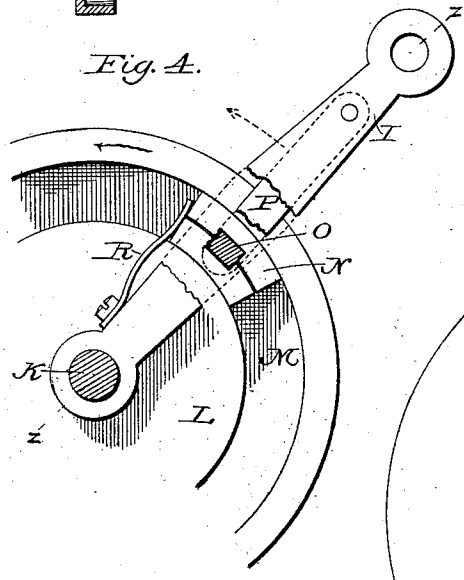
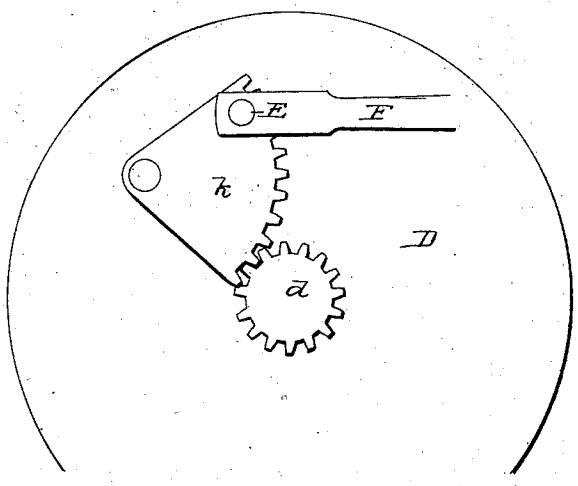


Fig. 6.



Attest:
James F. DuHamel
William H. Shipley

Inventor:
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P. T. Dodge.

UNITED STATES PATENT OFFICE.

ANDREW J. MARTIN, OF MACEDON, NEW YORK.

CHANGEABLE-SPEED GEARING.

SPECIFICATION forming part of Letters Patent No. 364,530, dated June 7, 1887.

Application filed December 4, 1886. Serial No. 220,672. (No model.)

To all whom it may concern:

Be it known that I, ANDREW J. MARTIN, of Macedon, in the county of Wayne and State of New York, have invented certain Improvements in Changeable-Speed Gearing, of which the following is a specification.

My invention relates to an improved mechanism whereby a crank or cranks revolving at a uniform speed may impart to a driven shaft a faster or slower motion, as demanded, the speed of the driven shaft being variable by imperceptible degrees between the extreme limits.

To this end the invention relates to the combination of a crank or cranks of variable throw with toggle-joints, and dogs or clutches carried by said joints and acting to revolve a wheel with which they engage, as hereinafter more fully explained.

Referring to the accompanying drawings, Figure 1 represents a top plan view of a mechanism in which my invention is embodied. Fig. 2 is a side elevation of the same. Fig. 3 is a cross-section on the line *x x*, Figs. 1 and 2. Fig. 4 is a side elevation, with parts shown in vertical section on the line *y y*, Fig. 5, showing one of the dogs or clutches. Fig. 5 is a cross-section on the line *z z* of the preceding figure. Fig. 6 is an outline view of a modification.

Referring to the drawings, A represents a substantial frame, which may be of any suitable form and construction, adapted to support the operative parts hereinafter described. B is a horizontal driving-shaft mounted in bearings on the frame, and provided with a driving-pulley, C, or other driving device, constituting the prime mover of my mechanism. To opposite ends of the shaft B are secured rigidly two wheels, D D′, each provided with a radial slot, *a*, containing a movable crank-pin, E, the inner end of which is attached to or formed into a slide adapted to engage suitable guides on the inner face of the wheel, this construction permitting the crank-pin to be moved to and from the center in order to vary the extent of its throw. Means of any suitable character may be used for adjusting the crank-pin; but I prefer the means which will be hereinafter described in detail. From the respective crank-pins I extend pitmen F F′ to opposite ends of the frame, where they are connected, respectively, to slides G and G′, working in horizontal guides H and H′. At a suitable distance from these slides I mount, parallel with the driving-shaft B, a driven shaft, K, having fixed on opposite ends the wheels L and L′, each having in its outer face a circular groove, M, concentric with the shaft.

On one end of the shaft K, I journal loosely two toggle-joints, I and J, which have their opposite ends pivoted or journaled to the slide G, the parts being so arranged that when the slide is moved to and fro the two toggles will be flexed or bent in opposite directions—one upward and the other downward. To each of these toggles I attach a friction-dog engaging the wheel L, and both tending when in action to turn it in one direction. The construction of these dogs is shown in Figs. 4 and 5, in which N represents a divided friction-block seated in the groove M of the wheel and recessed at the middle to receive an angular stud, O, fixed on the arm P, which latter is pivoted at its outer end to one of the members of the toggle. A spring, R, attached to the toggle bears on the block N and tends to urge the same endwise in the groove. When the arm of the toggle is moved forward, as indicated by the dotted arrow in Fig. 4, it carries forward the upper end of the arm P, causing the rest O on its inner end to separate the two parts of the block N and force them against opposite walls of the groove M. This action causes the blocks to engage with such firmness that the wheel is compelled to turn forward with the toggle and the arm P. When the motion of the toggle is reversed, the upper end of the arm P is turned rearward, and its rest O caused to relieve the block M from the internal pressure, so that it may slide freely backward in the groove under the influence of the spring R. The devices thus arranged form a friction dog or clamp which is noiseless in its action, and which acts instantly to lock the wheel to the toggle as the latter commences its forward motion.

Owing to the fact that the toggles I and J move in opposite directions, the dog of one will urge the wheel forward while the dog of the other is retreating, and thus it is that the two dogs acting alternately impart to the wheel a constant rotation.

On the opposite side of the machine I connect with the slide G' a second pair of toggles, I and J, provided with dogs to engage the wheel L, these parts being duplicates of those before described.

The crank-pins E and E', through which the toggle mechanism on opposite sides of the machine receive motion, are set "quarterly"—that is to say, on radial lines standing at an angle of ninety degrees to each other, or thereabout. The effect of this arrangement is to operate the toggles and clutches on opposite sides of the machine at such times, or in such relations to each other, that a practically constant rate of speed is imparted through the wheels L to the shaft K during its revolution. It is manifest that the crank, pitman, and toggle connections on one side of the machine could be omitted; but in such case the speed of the shaft K would vary greatly during each revolution. For many purposes it is necessary that the driven shaft should receive a practically constant speed during its entire revolution, and this is secured by the employment of the four toggles and clutches operating in the described relations.

By changing the throw of the crank-pins E and E' the length of the arcs through which the toggles vibrate may be increased or diminished, and in this manner the speed of the shaft K may be increased or diminished at will with reference to the speed of the driving-shaft B.

It will be observed, as a peculiarity of my organization, that this adjustment may be made gradually or by imperceptible degrees, and thus the speed of the driven shaft regulated with great nicety.

For the purpose of adjusting the crank-pins simultaneously and equally, I recommend the construction represented in Figs. 2 and 3, in which it will be perceived that the driving-shaft B is made of tubular form from end to end to receive a central shaft, *c*, bearing at its ends pinions *d*, which engage rack-bars *e*, attached to the respective crank-pins, as shown in dotted lines in Fig. 2. The rotation of the central shaft within the main shaft will therefore adjust the two crank-pins inward or outward and maintain them at equal distances from the center. As a means of turning this shaft and indicating the adjustment of the crank-pins, I attach to one end of the shaft C an arm or binder, *b*, arranged to traverse the outer face of the wheel D, which will be provided with suitable marks or graduations. When the speed of the driving-shaft is known, these graduations may be used to indicate, in connection with the pointer, the exact speed of the driven shaft. As a means for securing the pinion and crank-pins, I provide one end of the central shaft, *c*, with a nut, *f*, by which the shaft may be drawn endwise and the parts clamped tightly together to prevent the rotation of the pinions.

Instead of the sliding crank-pins above described, I may employ crank-pins mounted on swinging plates *k*, pivoted to the crank-wheels and provided with a sector-rack engaging adjusting-pinions, which will be mounted on the central shaft, as explained.

In the drawings I have shown the clutch-wheel L' provided with peripheral gear-teeth S, which impart motion, through a pinion, T, to a shaft, *n*, whence the motion may be communicated to any desired point; but it is to be understood that this shaft and pinion may be omitted and motion transmitted in any other suitable manner from the shaft K.

The essence of my invention lies in combining with a driven wheel, as L, a toggle having a dog to turn said wheel, and a crank adjustable as to its throw for operating said dog; and it is manifest that the details of construction may be variously modified by the skilled mechanic without departing from the limits of the invention.

My mechanism is adapted for application to steam-engines, grain-drills, grinding-machines, and generally to all structures in which a prime mover having a constant speed is required to transmit variable speeds to a driven shaft.

I am aware that toggle-joints provided with pawls have been combined with a ratchet-wheel driven by the pawls, and to such combination, broadly considered, I lay no claim.

If desired, the tightening-nut and the indicator-hand may be placed at one and the same end of the central shaft, and, where circumstances admit of its being done, the nut may be replaced by any equivalent means of securing the central shaft against rotation.

Having thus described my invention, what I claim is—

1. The driving-shaft and its two wheels having their crank-pins out of line, the pitmen, the two slides actuated thereby, the shaft K and its wheels L, the four toggle-joints, connected, two to each slide, and the friction-clamps connecting the respective toggle-joints with the wheels L, substantially as described, whereby a continuous and practically uniform motion may be communicated from the driving-shaft to the shaft K.

2. In a mechanism for imparting a variable rotary motion from a crank having a constant revolving speed, the combination of a driving-crank adjustable as to the length of its throw, a pitman connected thereto, a slide connected to and actuated by the pitman, a wheel, L, and two oppositely-arranged toggle-joints connected to the slide and provided with dogs acting alternately to turn the wheel L in one and the same direction.

3. In combination with the wheel L, a toggle provided with a dog to turn the wheel, a pitman to actuate the toggle, the driving-wheel provided with the tubular shaft and radially-movable crank-pin, and the central shaft provided with the pinion to adjust the crank-pin.

4. In combination with the tubular driving-shaft and the slotted wheels fixed thereon, the sliding crank-pins provided with racks and the

central shaft provided with pinions, whereby the two crank-pins may have their throw adjusted.

5. In combination with the tubular driving-shaft, the slotted wheels thereon, the sliding crank-pins provided with racks, the central shaft provided with pinions, and the hand or indicator attached to the last-named shaft.

6. In a variable-speed gearing, a driving-crank of variable throw, in combination with a toggle-joint operated thereby, a dog attached to the toggle-joint, and a wheel actuated by the dog, whereby the speed of the driven wheel may be increased or diminished without the speed of the driving-crank.

7. Two cranks arranged at an angle of ninety degrees, or thereabout, to each other, in combination with the four toggle-joints operated two by each crank, dogs attached to the toggle-joints and all acting in one direction, and a shaft, K, provided with fixed wheels actuated by the dogs, whereby a constant and practically uniform motion may be communicated to said shaft during its entire revolution.

In testimony whereof I hereunto set my hand, this 25th day of October, 1886, in the presence of two attesting witnesses.

ANDREW J. MARTIN.

Witnesses:
GEO. NOXON,
DE WITT C. BRUNDAGE.