L. HUFFMAN.

VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 31, 1912.

1,107,613.

Patented Aug. 18, 1914.

3 SHEETS—SHEET 1.

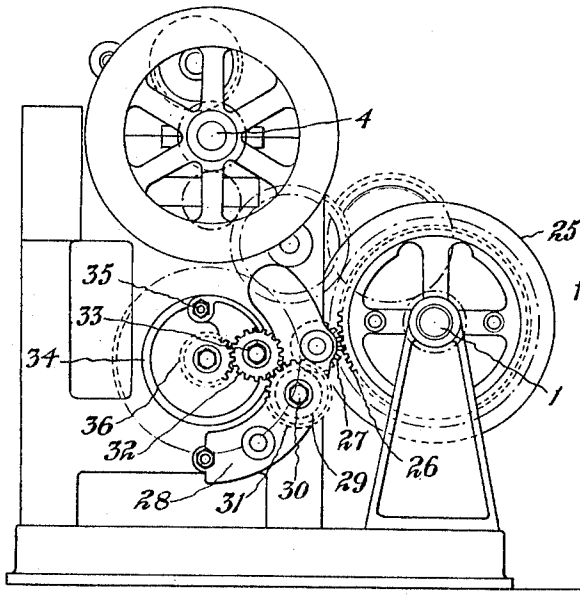


Fig. 1

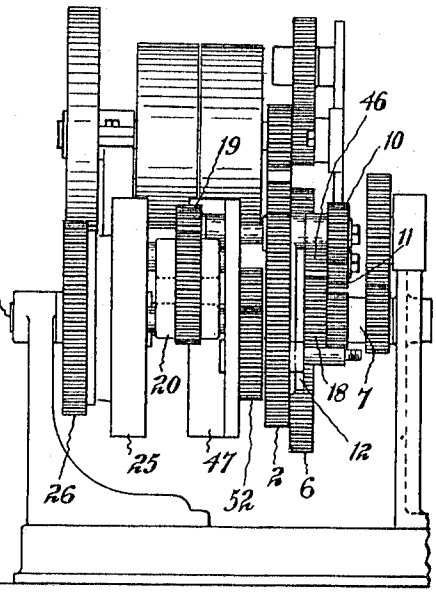


Fig. 2

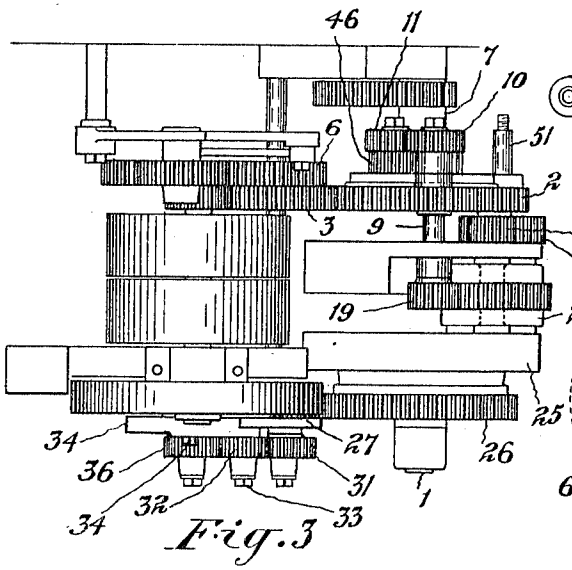


Fig. 3

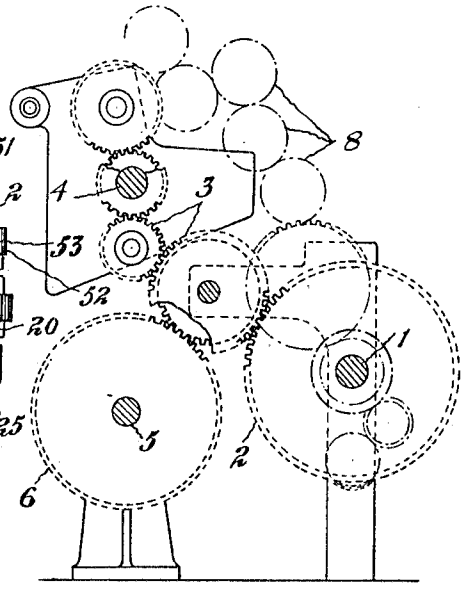


Fig. 4

WITNESSES:

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S. Lightfoot.

INVENTOR.

Louis Huffman

BY Rudolf & Marbee

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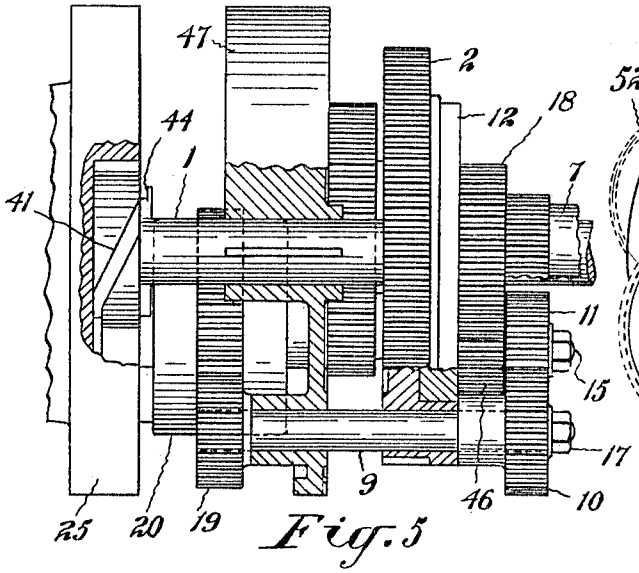


Fig. 5

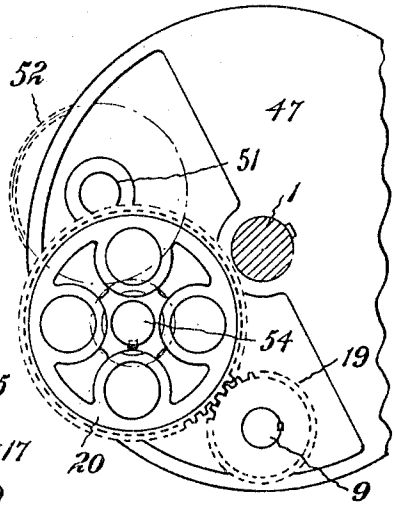


Fig. 7

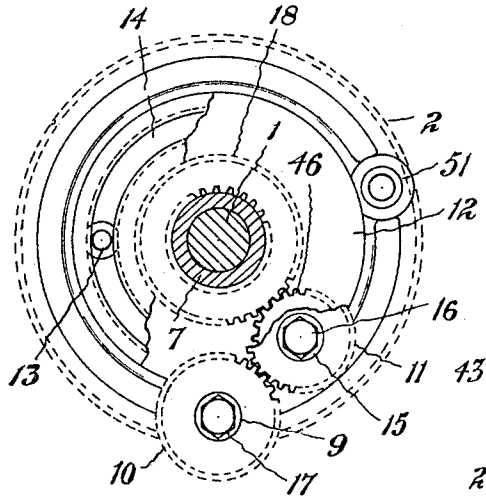


Fig. 8

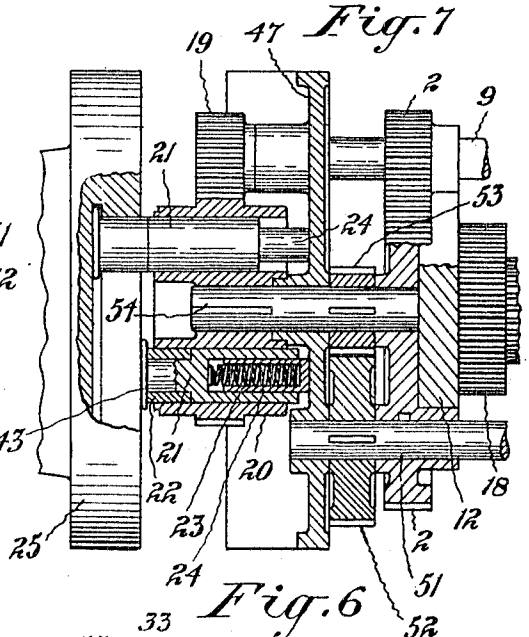


Fig. 6

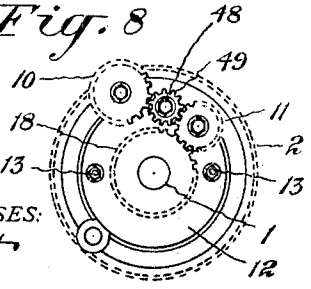


Fig. 13

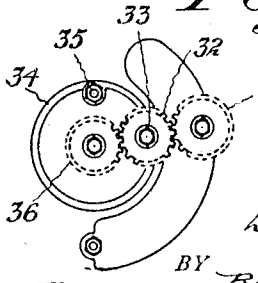


Fig. 14

WITNESSES:

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VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 31, 1912.

1,107,613. **Patented Aug. 18, 1914.**

3 SHEETS—SHEET 3.

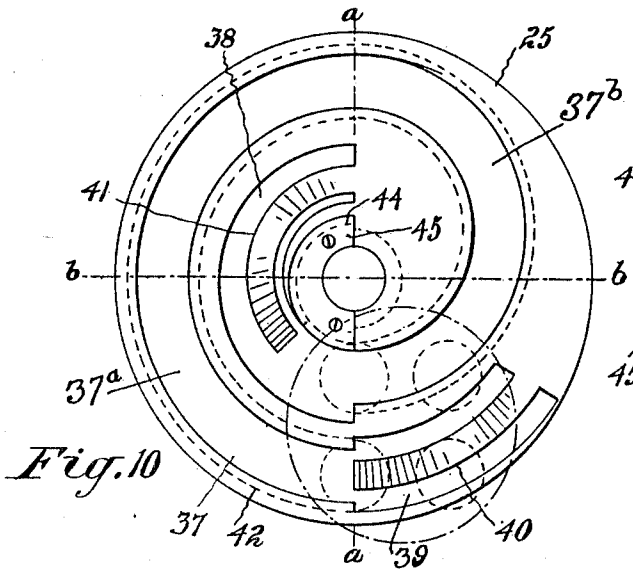


Fig. 10

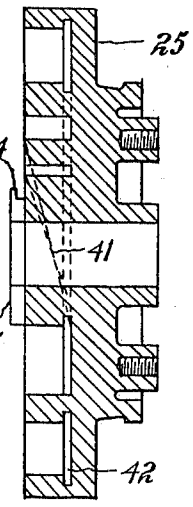


Fig. 11

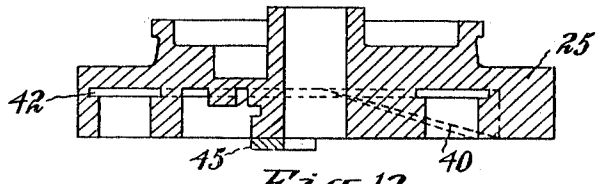


Fig. 12

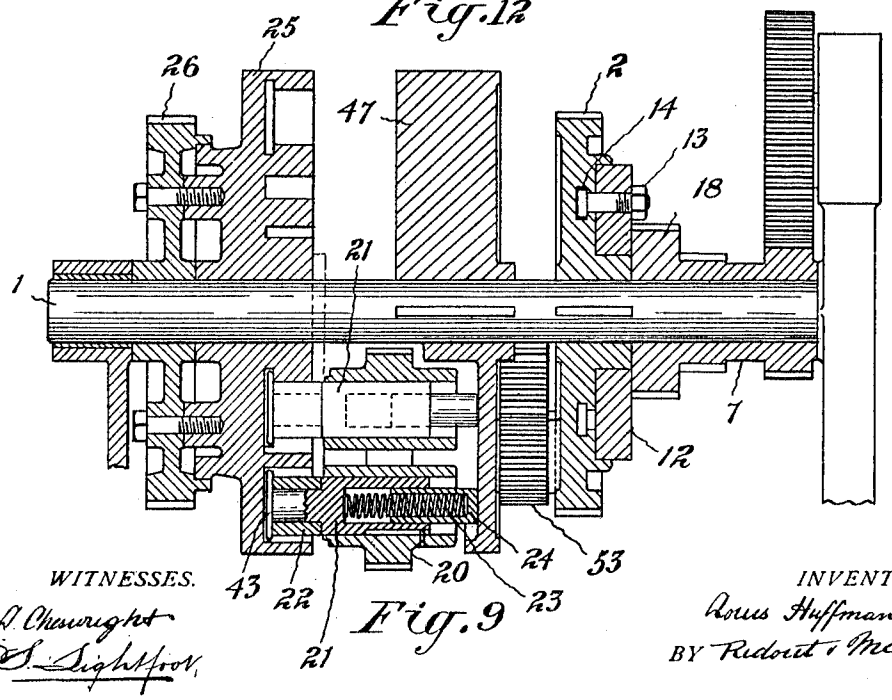


Fig. 9

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UNITED STATES PATENT OFFICE.

LOUIS HUFFMAN, OF TORONTO, ONTARIO, CANADA.

VARIABLE-SPEED MECHANISM.

1,107,613. Specification of Letters Patent. Patented Aug. 18, 1914.

Application filed August 31, 1912. Serial No. 718,050.

To all whom it may concern:

Be it known that I, LOUIS HUFFMAN, of the city of Toronto, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Variable-Speed Mechanism, of which the following is a specification.

This invention relates to means for producing intermittent variations in the speed of a rotary part normally driven at a constant speed, the periods of variation being equal in length to the periods of normal speed, and for varying the length of the arc during which the speed varies from normal. Such apparatus was disclosed in my prior U. S. Patent No. 1,018,617 dated Feb. 27th 1912 and Canadian Patent No. 131,365 dated Feb. 28th 1911 as used in connection with a printing press and the object of the present invention is to devise a simplified construction of variable speed mechanism specially adapted for use in such presses and in which the use of gears sliding under a load is entirely avoided.

I attain my object by means of the constructions illustrated in the accompanying drawings in which—

Figure 1 is an end elevation of my improved variable speed mechanism; Fig. 2 is a front elevation of the same; Fig. 3 is a plan view of the same; Fig. 4 is an end view showing certain of the gear trains; Fig. 5 is a plain view partly in section of part of the mechanism; Fig. 6 is a similar view showing the parts in a different position; Fig. 7 is a side elevation of the speed varying member and the disk carrying same; Fig. 8 is a side elevation of the gear train connecting the speed varying member with the rotary member actuated thereby; Fig. 9 is a longitudinal section illustrating particularly the parts carried by the constant speed shaft; Fig. 10 is a face view of the cam disk; Fig. 11 is a cross section of the same on the line *a*—*a*, Fig. 10; Fig. 12 is a section on the line *b*—*b*, Fig. 10. Figs. 13 and 14 are details showing the gear trains arranged for acceleration of the rotary driven member.

In the drawings like numerals of reference indicate corresponding parts in the different figures of the drawings.

Referring particularly to Figs. 1 to 4, 1 is a constant speed shaft suitably journaled in the frame of the apparatus. This shaft has the gear wheel 2 secured thereto and driven by means of the gear train 3 from the driving shaft 4. This same gear train also drives the shaft 5 through the medium of the gear wheel 6 secured thereto.

7 is a rotary driven member preferably loose on the constant speed shaft 1. It is the function of the apparatus as a whole to actuate this rotary member at the same speed as the shaft 1 for a portion of each revolution and at a varied speed during the remainder of each revolution, the periods of constant speed and varied speed being equal in duration. This rotary driven member by means of any suitable gear train such as 8 may be used to actuate any desired mechanism such, for example, as the cylinders of a printing press.

The driving connection between the rotary driven member 7 and the constant speed shaft is provided by the following mechanism: In the disk 47 secured to the gear wheel 2 and in the gear wheel is journaled a spindle 9 carrying a gear wheel 10 meshing with the gear wheel 11 journaled on the plate 12 rotatably carried by the gear wheel 2 so as to rotate concentric therewith. This plate may be clamped in any desired position by means of the bolt 13, the head of which engages the annular undercut slot 14 formed in the gear wheel 2. The gear wheel 11, it will be noted, is journaled on a stud 15 and is held in place thereon by means of the nut 16. The gear wheel 10, it will be noted, is also removably secured to the spindle 9 being held in place thereon by the nut 17. This enables me to replace the gear wheel 10 by one of a different size, the position of the gear wheel 11 being changed by adjusting the plate 12 as may be necessary to enable the gears 10 and 11 to properly mesh. The gear wheel 11 has secured thereto the gear wheel 46 meshing with the gear wheel 18 on the rotary driven member 7. It is evident that if the spindle 9 be held stationary that the rotary driven member will be actuated at the same speed as the constant speed shaft whereas if the spindle 9 be rotated in the same direction as, or in a contrary direction to, the shaft 1 that the rotary member will be actuated at a varied speed either faster or slower than the constant speed of the shaft depending on the direction in which it is rotated from the spindle 9. The spindle 9 has secured thereto the pinion 19.

20 is the speed varying member secured

to the spindle 54 journaled in the disk 47 and formed as a gear wheel meshing with the pinion 19. This speed varying member is intermittently rotated by the mechanism I will now describe.

Slidably supported in the speed varying member to move parallel to the axis thereof are a plurality of pins 21. The outer ends of these pins are preferably turned down as shown and the antifriction rollers 22 journaled thereon. These pins are acted on by coil springs 23 which tend to project them from the speed varying member as indicated at the upper part of Fig. 6. A preferable arrangement of the springs is shown particularly in the lower parts of Figs. 6 and 9.

Each pin is partly bored out and a pin 24 inserted therein also partly bored out to receive the coil spring 23 which bears, therefore, at one end against the pin 21, at the other end against the pin 24. The pins 21 are actuated *seriatim* to effect an intermittent rotation of the speed varying member 20 by the following means: Loose on the constant speed shaft 1 is the cam disk 25. This cam disk has formed on, or secured thereto, the gear wheel 26 which meshes with the pinion 27 journaled in the part 28 of the frame of the machine. This pinion 27 meshes with the pinion 29 secured to the spindle 30 journaled on the part 28 carrying at its outer end the pinion 31. This pinion 31 meshes with the pinion 32 journaled on the stud 33 on the plate 34. This plate is rotarily adjustable in exactly the same manner as the plate 12 and is clamped as adjusted by means of the nut 35, the plate being concentric with the shaft 5 which carries the pinion 36 meshing with the pinion 32. The pinions 31, 32 and 36 are all adjustably secured in place in a similar manner to the pinions 10 and 11 so that the gear ratio of the train may be varied as desired for a purpose which will hereinafter appear.

The cam disk 25 has the scroll cam groove 37 formed therein. (See particularly Figs. 10, 11 and 12). For an arc of 180° the cam groove is concentric with the shaft 1. (See 37^a Fig. 10.) For the remaining 180° it is eccentric thereto as shown at 37^b. At the inner end of the eccentric portion the cam groove is formed a substantially concentric portion 38 preferably extending through an arc of 180° and at the outer end of the concentric portion is formed an eccentric portion 39 extending through substantially an arc of 60°, these two latter described parts of the cam groove being used to effect the entrance and withdrawal of pins 21 from operative relationship with the scroll cam groove 37. Toward this scroll cam groove the pins 21 are projected by their springs. Each pin in turn enters the concentric portion 38 of the scroll cam groove. As the cam disk rotates the inner pin 21 passes out of the inner concentric portion and is actuated by the eccentric portion of the cam groove to effect a quarter revolution of the speed varying member 20.

As the springs 23 tend to maintain the pins in coöperative relationship with the disk or cam groove it is evident that means must be provided to cause the cam disk 25 to press back the pins out of their coöperative position after each in turn has been acted upon to produce a partial rotation of the speed varying member. For this purpose I provide the inclined cam 40 located in the mouth of the eccentric portion 39 and leading from the bottom thereof to the level of the face of the disk. Each pin in turn as it reaches the outer end of the scroll cam groove is thus forced out. The pins are gradually guided to their coöperative position by means of the incline cam 41 located in the concentric portion 38 of the scroll cam groove extending from the bottom thereof up to the level of the face of the disk. To insure the pins remaining out of coöperative relationship with the scroll cam groove except as they enter one by one through the part 38, I prefer to undercut the bottom of the cam groove to form the shoulders 42 to receive the circular flanges 43 formed on the ends of the pins 21. It will be noted that these shoulders are not formed in the outer eccentric portion 39 of the cam groove so that no obstacle is offered to the movement of the pins down the inclined cam 41. It follows therefore that the heads of the pins cannot enter the cam groove except as they enter the part 41 so that once they emerge from the part 40 they travel over the face of the disk till they again reach a position in which they will enter the part 41 once more.

It will be noted that the need for the portion 38 of the cam groove being made concentric and the portion 39 eccentric is that a second pin will enter the portion 38 as the preceding pin reaches the concentric portion of the main groove 37, and that a pin emerges through and from the portion 39 as a succeeding pin enters the eccentric portion of the main groove 37. The simultaneous engagement of two pins at the same time by the cam disk 25 is important as it gives an effective lock against any movement of the speed varying member 20, except as determined by the controlling cam surfaces.

A shoulder 44 is preferably formed at the inner side of the concentric portion 38 of the cam groove by means of the plate 45 suitably secured in place. This shoulder is of service in insuring passage of a pin down the incline cam 41, as when the cam disk is rotated that portion of the cam groove is the leading end of the same.

The operation of the device is as follows: For every rotation of the cam disk 25 the speed varying member 20 is rotated a fixed

amount, in this case one quarter of a revolution. It is evident then, that the arc through which the varied speed of the rotary member 7 takes place will depend on the gear ratio of the train formed by the gears connecting the speed varying member 20 with the rotary driven member 7. It is also evident that as the cam disk 25 is operative on the speed varying member through an arc of 180° and is non-operative through an arc of the same number of degrees that the duration of the arc of varied speed of the member 7 will be exactly equal to that of constant speed. It will also be evident that as the rotary driven member for a portion of each revolution is driven at a different speed from the remaining portion of the revolution that one revolution of the rotary driven member does not correspond with one revolution of the constant speed shaft. Therefore, the number of the periods of variable speed will be either greater or less than the revolutions of the constant speed shaft in a given time according as the varied speed is a retardation or an acceleration and that the frequency of the periods of variable speed will vary with the arc through which variation takes place, and therefore, with the speed of variation. It is essential therefore that if the ratio of the gearing between the speed varying member 20 and the rotary driven member 7 be varied to produce a change in the arc in which variation takes place that the ratio of the gearing between the cam disk 25 and the constant speed shaft be correspondingly varied. It is for this purpose that the gears 31, 32 and 36 are made removable and adjustable as already described so that the gear ratio may be changed to suit any changes made by adjusting the gears 10 and 11.

As the device is shown it is arranged to effect a retarded movement during the period of speed variation. If it be desired to effect an acceleration during the period of speed variation it is necessary to introduce another gear between the spindle 9 and the member 7. This may be done by securing another gear 49 to the plate 12 which is provided with a stud 48 for that purpose which gear meshes with the gear 10 and the gear 11 so that the rotary driven member is driven ahead of the constant speed shaft during the period of speed variation. See Fig. 13. A similar change is made in the gear train driving the cam disk 25 the gears 29 and 31 being dropped out and a gear 50 secured on the spindle of the gear 27 meshing directly with the gear 32. To aid in effecting gear changes to vary the arc of differentiated speed without the use of too many separate gears, I journal a second spindle 51 in the disk 47 and gear 2 which spindle carries the gear 52 meshing with the pinion 53 secured on the spindle 54 of the speed varying member 20. The ratio between the gears 52 and 53 is different from that between the speed varying member and the spindle 9 so that if the same gears be used as between the spindle 9 and the rotary member a different rate of variation will be obtained.

What I claim as my invention is:—

1. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member loose on the said shaft; a spindle geared to the driven member; a bearing member for the spindle secured to the constant speed shaft; a rotatable speed varying member secured to said spindle; a rotatable member adapted to intermittently rotate said speed varying member; and means for actuating said rotatable member at a pre-determined speed relative to the constant speed shaft.

2. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member loose on the said shaft; a spindle geared to the driven member; a bearing member for the spindle secured to the constant speed shaft; a rotatable speed varying member secured to said spindle; a rotatable member adapted to intermittently rotate said speed varying member; means for actuating said rotatable member at a predetermined speed relative to the constant speed shaft; means for varying the ratio of the gearing between the aforesaid spindle and the driven part; and means for varying the ratio of the gearing between the rotatable member actuating the speed varying member and the driving shaft.

3. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; speed varying mechanism forming a driving connection between the said shaft and the driven member whereby the driven member may be driven at the same speed as the shaft, said mechanism including a gear train; means geared to the said shaft adapted to intermittently actuate the speed varying mechanism to produce periods of speed variation equal in duration to the alternating periods of constant speed; means for changing the gearing between the shaft and driven member to vary the arc through which the rotary driven member is driven at the varied speed; and means for changing the gearing between the constant speed shaft and the means for actuating the speed varying mechanism to vary the frequency of the periods of speed variation.

4. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed-varying member and the driven member; rotary actuating mechanism for the speed-varying member geared

to the constant speed shaft and adapted to intermittently actuate the speed varying mechanism to produce periods of speed variation equal in duration to the alternating periods of constant speed; means for changing the gearing between the shaft and driven member to vary the arc through which the rotary driven member is driven at the varied speed; and means for changing the gearing between the constant speed shaft and the means for actuating the speed varying mechanism to vary the frequency of the periods of speed variation.

5. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed-varying member and the driven member; a plurality of pins slidable in the speed-varying member parallel to its axis; a cam disk journaled concentric with the constant speed shaft and geared thereto, said cam disk carrying a cam adapted to engage said pins to intermittently rotate the speed-varying member, said cam having its surface concentric with the shaft for an angle of 180°; and means for bringing said pins *seriatim* into and out of the path of the cam.

6. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed-varying member and the driven member; a plurality of pins slidable in the speed-varying member parallel to its axis; a cam disk journaled concentric with the constant speed shaft and geared thereto, said cam disk carrying a cam adapted to engage said pins to intermittently rotate the speed-varying member, said cam having its surface concentric with the shaft for an angle of 180°; and means for bringing said pins *seriatim* into and out of the path of the cam comprising springs tending to project the pins from the speed-varying member and a cam on the face of the cam disk adapted to push back said pins.

7. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed-varying member and the driven member; a plurality of pins slidable in the speed-varying member parallel to its axis; a cam disk journaled concentric with the constant speed shaft and geared thereto, said cam disk carrying a scroll cam adapted to engage said pins to intermittently rotate the speed-varying member; and means for bringing said pins *seriatim* into and out of the path of the cam.

8. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed-varying member and the driven member; a plurality of pins slidable in the speed-varying member parallel to its axis; a cam disk journaled concentric with the constant speed shaft and geared thereto, said cam disk carrying a scroll cam adapted to engage said pins to intermittently rotate the speed-varying member; and means for bringing said pins *seriatim* into and out of the path of the cam comprising springs tending to project the pins from the speed varying member and a cam on the face of the cam disk following the configuration of the scroll cam adapted to push back said pins.

9. In variable speed mechanism the combination of a constant speed shaft; a rotary driven member; a bearing member secured to said shaft; a rotary speed varying member journaled in said bearing member; gearing between said speed varying member and the driven member; a plurality of pins slidable in the speed varying member parallel to its axis; a cam disk concentric with the constant speed shaft; said cam disk carrying a scroll cam adapted to engage said pins to intermittently rotate the speed varying member; and means for bringing said pins *seriatim* into and out of the path of the cam.

Toronto, this 28th day of August, 1912.

LOUIS HUFFMAN.

Signed in the presence of—

J. EDW. MAYBEE,

A. CAMPBELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."