

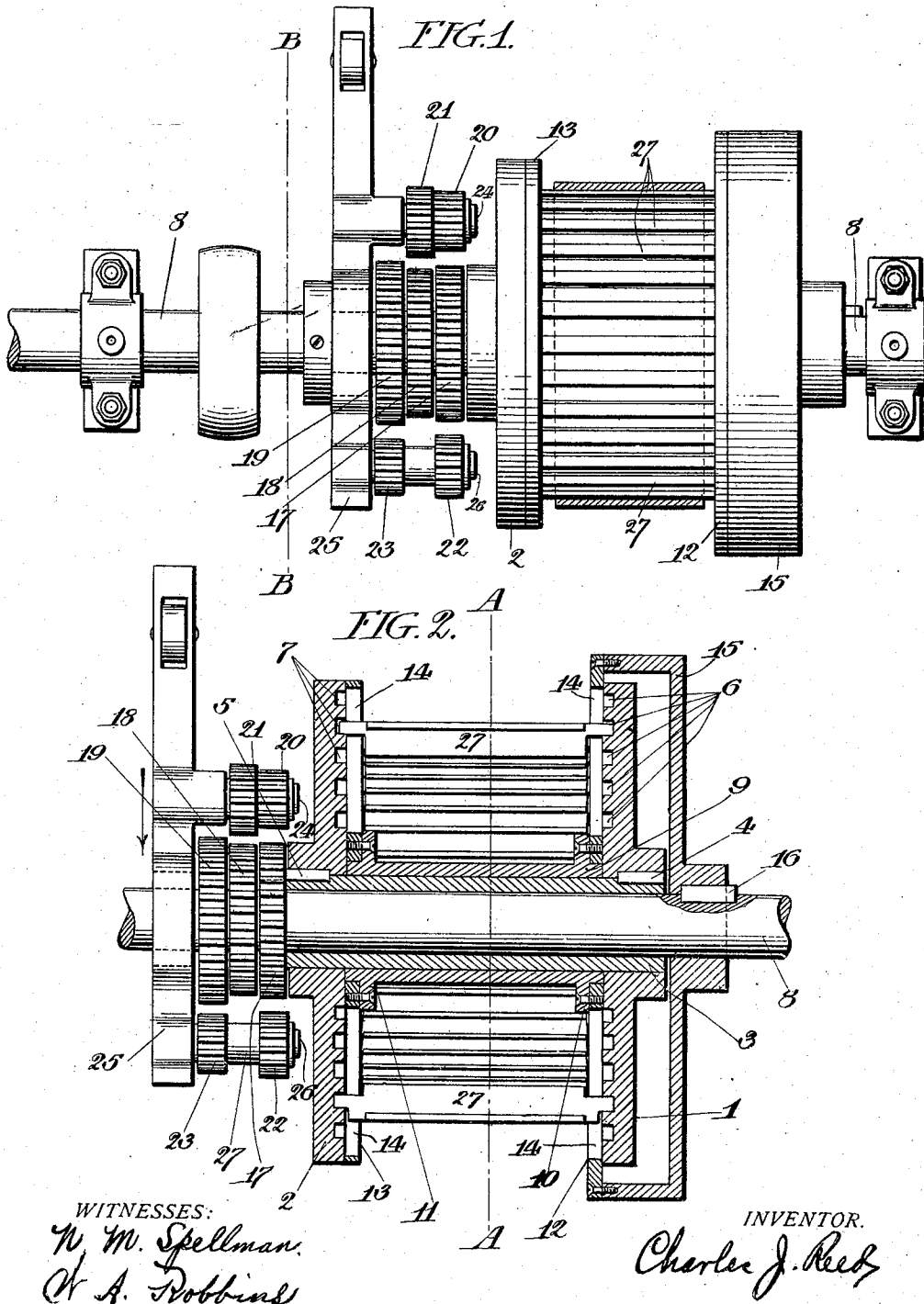
No. 858,754.

PATENTED JULY 2, 1907.

C. J. REED.
SPEED CHANGING MECHANISM.

APPLICATION FILED JULY 7, 1903.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

FIG. 3.

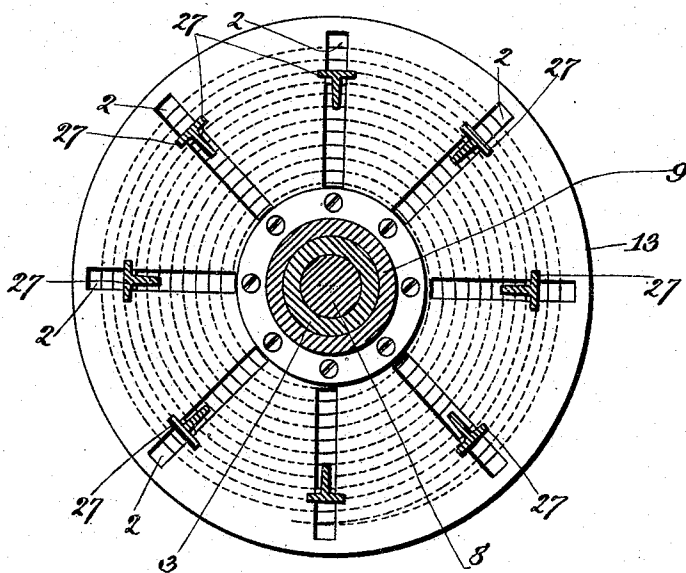


FIG. 4.

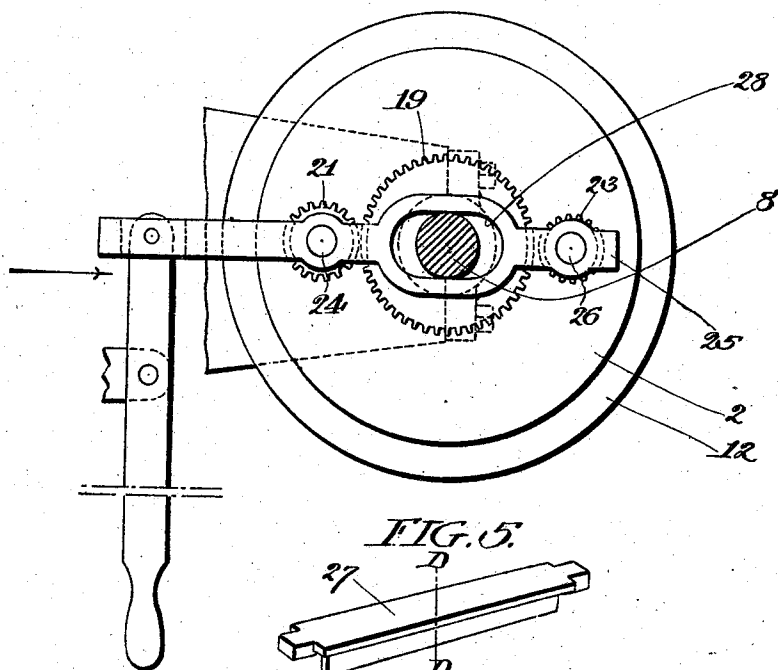


FIG. 5.

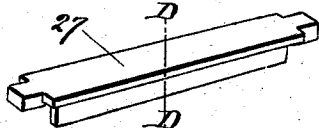


FIG. 8.



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3 SHEETS—SHEET 3.

FIG. 6.

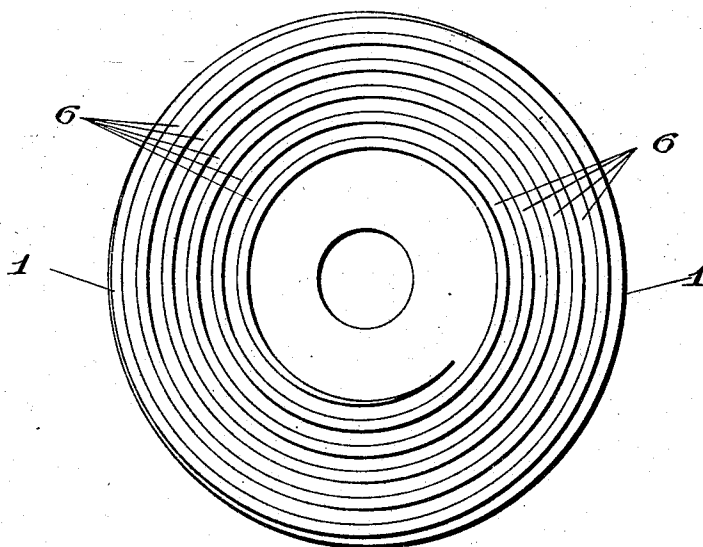
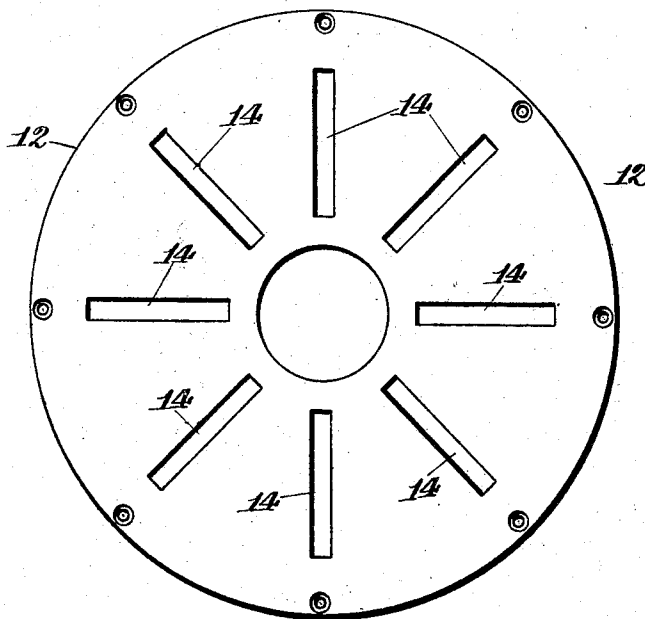


FIG. 7.



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SPEED-CHANGING MECHANISM.

No. 858,754.

Specification of Letters Patent.

Patented July 2, 1907.

Application filed July 7, 1903. Serial No. 164,523.

To all whom it may concern:

Be it known that I, CHARLES J. REED, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Speed-Changing Mechanisms, of which the following is a specification.

My invention relates to mechanisms for transmitting power at a variable speed and is particularly adapted for use in connection with expansible pulleys of the type shown in United States Patent No. 78,763 and No. 424,687, in which the rim of a pulley is expanded or contracted in diameter by the relative rotation of two disks, one provided with a spiral thread or groove and the other with radial slots in which move segments of the rim.

The particular object of my invention is to provide a means for the operation of such pulleys whereby I am enabled to either increase or decrease the diameter by any desired amount while the pulley is running continuously in one direction at high speed and to maintain entire control over such variations in diameter through means operated by power which is derived from the shaft carrying the pulley.

In order to avoid these difficulties and to provide a mechanism for varying the diameter of a pulley while it is in rapid motion in one direction, and to enable me at will to either increase or diminish the speed of a countershaft by an exact and required amount without stopping the machinery or reversing the direction of motion, I employ the improved mechanism described in the following specification and illustrated in the accompanying drawing, in which

Figure 1 represents a top view of one form of pulley; Fig. 2, a top view of the same partly in longitudinal section; Fig. 3, a transverse section taken on line A—A of Fig. 2; Fig. 4, an end view; Figs. 5, 6, 7, and 8, parts of the same.

Similar letters refer to similar parts throughout the several views.

Referring in detail to the drawing, 1 and 2, Figs. 2 and 3, represent scroll disks of any suitable material, such as iron or brass, attached to the tube or sleeve, 3, by means of the keys, 4 and 5. Each of these disks has a spiral thread or groove, 6 and 7, cut on one face as shown clearly in Fig. 6. The thread, 6, on disk, 1, is cut in a clockwise or right-handed direction passing from center towards the circumference as shown in Fig. 6. The thread, 7, on disk 2, is cut in an anti-clockwise or left-handed direction passing from the center outwards. The disks, 1 and 2, are keyed on the tube, 3, with their grooved surfaces facing each other. The tube, 3, is mounted so as to turn easily on the shaft, 8. Mounted upon the tube, 3, so as to turn easily upon it, and between disks, 1 and 2, is the tube, 9,

having two flanges, 10 and 11, which are bolted respectively to the main disks, 12 and 13. The disks, 12 and 13, fit closely against the grooved surface of 1 and 2 respectively and are provided each with the same number of radial slots, 14, shown in Fig. 7. Each slot in 12 is arranged in the same plane with a corresponding slot in 13, so that a bar or pulley-segment inserted in the corresponding slots of 12 and 13 can be moved towards and from the shaft and remain in the same radial plane. A flanged head or disk, 15, is mounted upon 8 and attached thereto by the key, 16. The outer rim of 12 is screwed or bolted to the flange of 15, so that the disks, 12 and 13 and the tube 9, are rigidly attached through 15 and 16 to the shaft, 8, and turn with it. A spur gear, 17, is mounted upon and attached to the tube, 3, or it may be attached to the hub of the disk, 2. Spur gears, 18 and 19, are keyed to the shaft, 8. Small spur gears, 20 and 21, are attached to each other and turn loosely upon a pin, 24, carried by the shifter, 25. This shifter also carries the pin, 26, on which is mounted to turn loosely the tube, 27, carrying the gears, 22 and 23. The shaft, 8, passes through a longitudinal slot, 28, in the shifter indicated by dotted lines in Figs. 1 and 2. The shifter may be moved longitudinally in the direction indicated by the arrow, so as to bring gears, 20 and 21, into engagement with gears, 17 and 18, respectively; or in the opposite direction so as to bring the gears, 22 and 23 into engagement with the gears, 17 and 19, respectively. When the shifter is in a position midway between these extremes none of the gears are in engagement. The gears, 17, 18, 19, 20, 21, 22, and 23 are all of the same pitch. In the drawing I have shown gears having the following numbers of teeth. No. 17 has 72 teeth, No. 18 has 71 teeth, No. 19 has 73 teeth, No. 20 has 36 teeth, No. 21 has 37 teeth, No. 22 has 36 teeth, No. 23 has 35 teeth.

It will be readily seen by those skilled in the art that when the shaft is rotating and the gears are all out of engagement, there will be no relative movement of the grooved disks with reference to the slotted disks. All will turn together with the speed of the shaft. When the gears, 20 and 21, are thrown into engagement, the tube, 3, and disks, 1 and 2, will move in the same direction as the shaft and disks, 12 and 13, but at a slower speed, the reduction in speed being to $\frac{1}{3} \times \frac{3}{4}$, or 96 per cent. of the speed of the shaft. When the gears, 22 and 23, are thrown into engagement, the tube, 3, and its disks will move in the same direction as the shaft, but at a greater speed, the increase being to $\frac{7}{3} \times \frac{3}{4}$, or 104.5 per cent. of the speed of the shaft.

In each of the radial slots of 12 is inserted one end of a bar, slat or pulley-segment, 27, formed of a short piece of T-rail and shown in detail in Figs. 5, and 8. The other end of 27 is inserted in the corresponding

- slot in 13. One end of 27 extends through 12 into the spiral groove of 1, and the other end extends through 13 into the spiral groove of 2, each slat being parallel to the shaft. These slats taken together constitute the convex or cylindrical surface of the pulley, and the pulley expands and contracts as these slats move respectively from or towards the shaft. The projecting ends of the slats are so located as to bring the external surface of all the slats equally distant from the shaft.
- 10 When the disks, 1 and 2, rotate faster than the shaft (and, consequently, faster than the disks, 12 and 13), the slats will all move towards the shaft, if the intersections of the spiral grooves and the radial slots are centripetal. If these intersections are centrifugal, the slats will move from the shaft. If centrifugal motion is produced by revolving the grooved disks faster than the shaft, centripetal motion will be produced by revolving them slower and vice versa. Consequently, with the grooves in a given direction and the shaft revolving in a given direction, the pulley will expand when the shaft moves faster than the tube, 3, and contract when it moves slower. Reversing either the direction of the grooves or the motion of the shaft reverses this relation.
- 25 It will be seen that in the mechanism described herein the pulley consists of two elements, one of which is fixed immovably to the shaft, the other being movable around the shaft through the intervention of a train of gearing between the shaft and the movable element. The fixed element comprises the slotted disks, 12 and 13, the tube, 9, the head, 15, the gears, 18 and 19, and the slats, 27; while the movable element comprises the grooved disks, 1 and 2, the tube, 3, and the gear, 17.
- 30 In the mechanisms herein described I employ in changing the effective diameter of the pulley, power derived from the rotating shaft, both for increasing and for diminishing the diameter, that is, for rotating the movable element in either direction on the shaft or with reference to the fixed element. I do this while the pulley is in motion through the intervention of a mechanism which changes the movable element in either direction at a definite and predetermined speed, less than the speed of the shaft, and by an amount that is always under control of the operator. My claims are intended to cover broadly, not only the specific forms herein shown, but all forms of mechanism capable of accomplishing these objects in the manner described and claimed.
- 50 What I claim as my invention, and desire to secure by Letters Patent, is—
1. An expansible pulley containing a pair of spirally grooved disks rigidly united together and movable around the shaft, and a pair of inner radially slotted disks rigidly secured to the shaft, substantially as set forth.
 2. An expansible pulley comprising a tube, a pair of spirally grooved disks attached to the tube and movable therewith around the shaft, and a pair of inner radially slotted disks fixed to the shaft, substantially as set forth.
 3. An expansible pulley containing a pair of spirally grooved disks, both movable simultaneously in the same direction around the shaft, and a pair of inner radially slotted disks rigidly secured to the shaft, substantially as set forth.
 4. An expansible pulley containing a pair of outer spirally grooved disks movable around the shaft, a pair of inner radially slotted disks rigidly fixed upon the shaft, and gears for rotating the spirally grooved disks around the shaft either backwards or forwards at a predetermined speed less than that of the shaft while the shaft is revolving, substantially as set forth.
 5. An expansible pulley containing a pair of outer spirally grooved disks movable around the shaft, a pair of inner radially slotted disks rigidly fixed upon the shaft, and gears adapted to move the spirally slotted disks simultaneously around the shaft either backwards or forwards at a speed less than that of the shaft, substantially as set forth.
 6. An expansible pulley containing a pair of outer spirally grooved disks movable around the shaft, a pair of inner radially slotted disks fixed upon the shaft, and spur gears adapted to rotate the spirally grooved disks around the shaft while the shaft is revolving, substantially as set forth.
 7. An expansible pulley containing a pair of outer spirally grooved disks movable around the shaft, a pair of inner radially slotted disks fixed upon the shaft and a train of gears adapted to move the spirally grooved disks simultaneously in the same direction around the shaft at a speed less than that of the shaft, substantially as set forth.
 8. An expansible pulley containing a pair of outer spirally grooved disks which are movable around the shaft and a pair of inner radially slotted disks which are fixed upon the shaft, in combination with a train of gears for rotating both of the spirally grooved disks in the same direction around the shaft, substantially as set forth.
 9. An expansible pulley containing a pair of outer spirally grooved disks which are movable around the shaft, a pair of inner radially slotted disks which are fixed upon the shaft, and a train of gears for rotating both of the spirally grooved disks in the same direction around the shaft while the shaft is revolving, substantially as set forth.
 10. An expansible pulley containing a pair of outer spirally grooved disks movable around the shaft, a pair of inner radially slotted disks fixed upon the shaft, a train of gears for rotating both of the spirally grooved disks simultaneously in one direction around the shaft, and means for throwing the gears into and out of engagement, substantially as set forth.
 11. An expansible pulley containing a pair of outer spirally grooved disks both movable in the same direction around the shaft, a pair of inner radially slotted disks fixed upon the shaft and means for moving the spirally grooved disks around the shaft, substantially as set forth.
 12. An expansible pulley containing a pair of outer spirally grooved disks both movable in the same direction around the shaft, a pair of inner radially slotted disks rigidly attached to the shaft, and means for moving the spirally grooved disks around the shaft at a speed less than that of the shaft while the shaft is revolving, substantially as set forth.
 13. The combination of a shaft, a radially slotted main disk fast thereon, radially-movable pulley-segments upon the main disk, a rotatory segment-adjusting device, an element fast with the main disk, a differential element fast with the segment-adjusting device, a countershaft, and means upon the countershaft for connecting the main disk with the elements of the differential.
 14. The combination of a slotted main disk, a threaded scroll disk rotatably mounted upon the main disk, radially-movable pulley segments having threads engaging the scroll disk, an element movable with the main disk, differential gearing fast with the scroll disk, a countershaft, means upon the countershaft connecting the main disk and differential, means connected with the differential gearing for selectively engaging the desired gear of the differential, and means connecting the main shaft with the selective engaging means.
- In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.
- CHARLES J. REED.
- Witnesses:
SAMUEL J. TAYLOR,
N. M. SPELLMAN.