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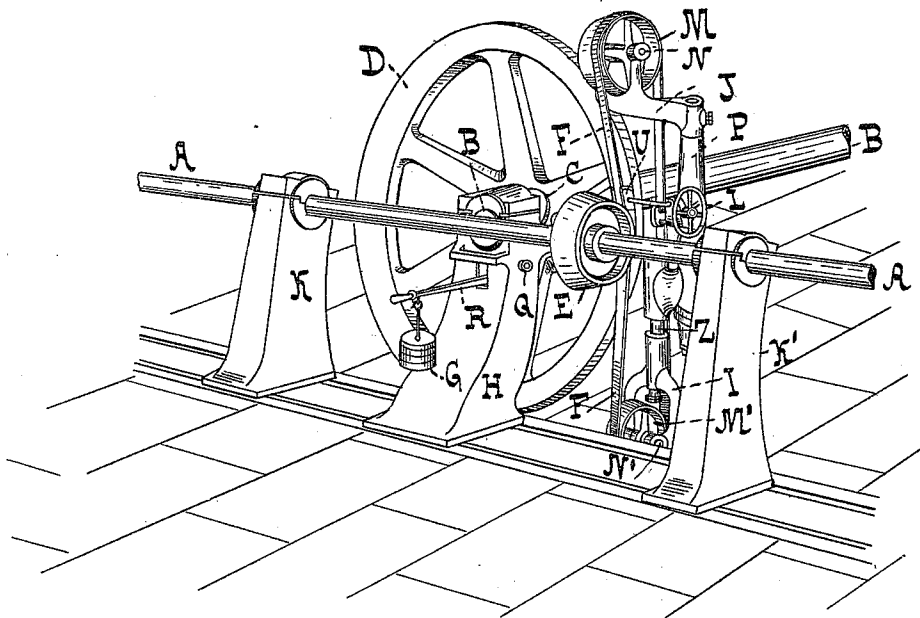
2 Sheets—Sheet 1.

C. SEYBOLD.
VARIABLE SPEED FRICTION GEAR.

No. 570,235.

Patented Oct. 27, 1896.

Fig. 1.



WITNESSES:

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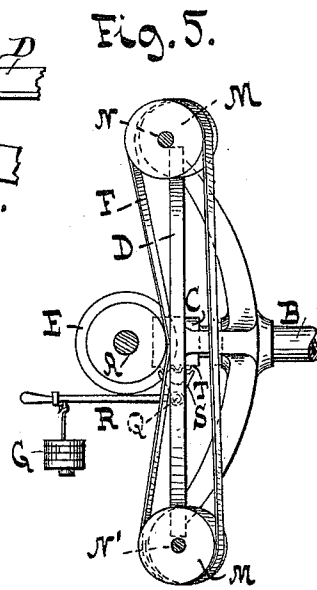
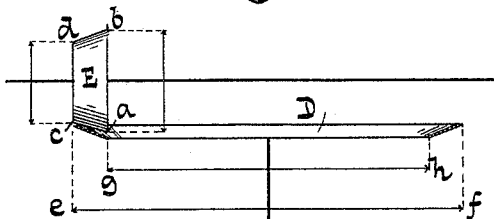
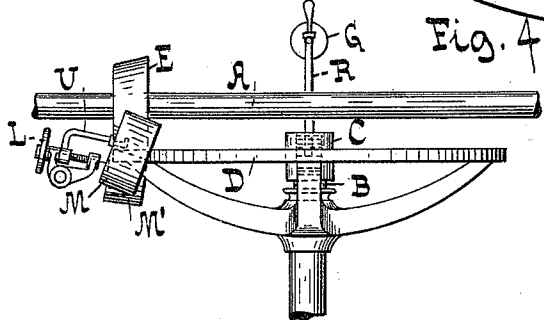
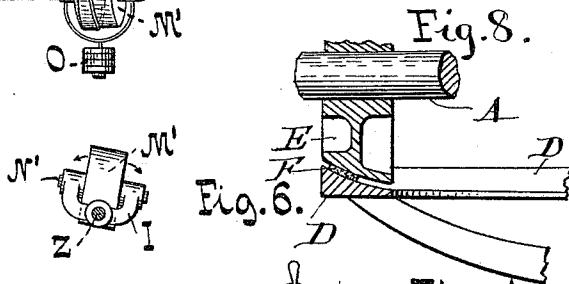
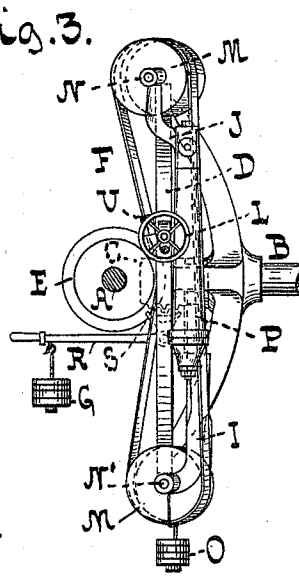
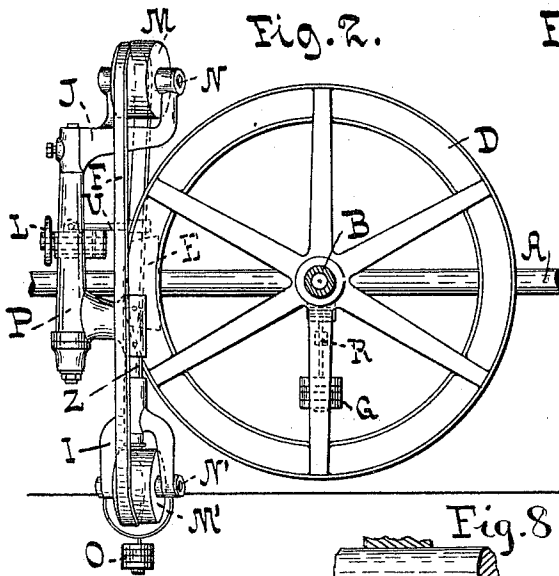
(No Model.)

2 Sheets—Sheet 2.

C. SEYBOLD.
VARIABLE SPEED FRICTION GEAR.

No. 570,235.

Patented Oct. 27, 1896.



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CHRISTIAN SEYBOLD, OF ZWEIBRÜCKEN, GERMANY.

VARIABLE-SPEED FRICTION-GEAR.

SPECIFICATION forming part of Letters Patent No. 570,235, dated October 27, 1896.

Application filed August 30, 1895. Serial No. 561,007. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN SEYBOLD, a subject of the Emperor of Germany, and a resident at Zweibrücken, in the Kingdom of Bavaria, Germany, have invented new and useful Improvements in Variable-Speed Friction-Gears, of which the following is a specification.

My invention has reference to variable-speed friction-gears, and especially to improvements in the devices described and shown in an application for Letters Patent filed by me May 8, 1895, Serial No. 548,566; and it has for its object to improve and render more efficient and reliable the transmission therein shown.

The nature of my invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a perspective view of my improved friction-gear. Fig. 2 is a front elevation. Fig. 3 is a side elevation. Fig. 4 is a plan or top view. Fig. 5 is a side view with parts omitted. Fig. 6 is a detail view. Fig. 7 is a diagrammatic view of the friction-pulleys. Fig. 8 is a sectional view illustrating the concavity and convexity of the pulleys, said figure being drawn on an enlarged scale.

Similar letters of reference designate corresponding parts throughout the several views of the drawings.

The improved construction herein shown is particularly applicable in those cases in which one shaft is required to drive a number of other shafts, all located at a right or other angle thereto, the speeds of which latter shafts are to be separately adjustable and which are to be thrown out of gear either separately or simultaneously. It is, however, equally applicable for transmitting motion to a single shaft located at an angle to the driving-shaft.

In the drawings above referred to the letter A designates the driving-shaft, mounted on suitable standards K K' and which is to impart motion to one or more driven shafts B. The shaft B is carried in a bearing at C, which can be shifted in the direction of the length of said shaft in the block or standard H. On said shaft is mounted a friction-pulley D, which receives motion from a friction-pulley E on the shaft A through the medium of the

friction-belt F. The face of the driving-pulley E is made slightly convex, while that of the driven pulley is correspondingly concaved. The driven pulley D is forced against the driving-pulley E by any suitable means. In the present example I have shown a lever R, fulcrumed on a fixed pin Q and provided in the line of its fulcrum with a toothed segment S, which engages with a rack T or worm-wheel on the lower side of the movable bearing C.

At or near the free end of the lever R is suspended an adjustable weight G. By raising the lever R, and consequently the weight G, the frictional pressure between the driving and driven pulleys is removed, and consequently the rotation of the driven shaft B is arrested. It is of course evident that any other suitable means involving the use of weights or springs, with or without the use of levers, for the purpose of pressing the two pulleys together, can be substituted for those shown.

The shifting of the friction-belt F between the two pulleys E D for the purpose of varying the speed of transmission is effected by the belt-guide U, provided with a hand-wheel L.

In practical trials with friction-gears of the character above described it has been found that the frictional belt F must embrace so much of the periphery of the driving-pulley E that the belt F will be carried along thereby, even when the driven pulley D is stationary—that is to say, when the latter is thrown out of gear by raising the weight G or lever R. This continued motion of the belt when the driving and driven pulleys are out of gear is necessary because otherwise the friction-belt F would be ground through at one point by the frictional action of the rotating driving-pulley. The slightest wear of the belt at any one point by this grinding or scouring action would give rise to an irregular transmission of motion, resulting in the rapid wear of the friction-belt. On this account the guide-rolls M M' for the belt, which are located, respectively, above and below the driving-pulley E, Figs. 1, 3, 4, and 5, are so placed or alined that that side of the belt which passes to the point of frictional contact with the driving-pulley E is bowed or runs in an obtuse

angular path, while the other or dead side of the belt is permitted to run in a straight path or line. In other words, the periphery of the driving-pulley E extends across the planes of the peripheries of the guide-rolls. This necessity of causing the belt F to partially embrace the driving-pulley E determines a certain relation between the sizes of the driving and driven pulleys E and D. This ratio must not be less than one to three, as otherwise the disadvantage arises that the surfaces of the driving-pulleys E and D become too steep, the result of which would be that the friction-belt F, when sufficiently embracing the driving-pulley E for the purpose above described, would have a tendency, notwithstanding the concave and convex forms of the surfaces, to run toward the higher edge or larger diameter of the pulley E.

In order that the friction-belt F in the disengaged condition of the gear shall always be carried along with certainty by the pulley E, it is also necessary, in addition to the former properly embracing the latter and the proper proportions of D and E, that the belt F shall always have a uniform tension imparted thereto. This tension of the belt is also necessary for the gearing when engaged and must be produced automatically as the belt F, as usual, stretches, such stretching being increased by the lateral pressure exercised by the pulleys D and E upon the belt. For producing the tension above described the lower guide-roll M' of the belt F is arranged, as shown in Figs. 1, 2, and 3, in a fork I, freely movable downwardly on a rod Z, and by means of springs, weights, or weighted levers O, acting on this freely-movable yoke, and consequently on the roller M', the belt is maintained in a very uniform state of tension.

Furthermore, it has been found advantageous that the guide-rolls M M' should not both lie in the direction of the contact-surfaces of the friction pulleys, or rather that neither of said pulleys should lie with its periphery in the direction of the surface of contact of the pulleys D and E, but that the upper guide-roll M only should be adjusted to this position, while the lower roll M' should have its axis in a twisted position, or at an angle relative to that of the roll M. Preferably the axis of the upper roll M is also not parallel to the surface of contact of the pulleys D and E, while the axes of both guide-rolls are also at an angle to each other, as shown in Fig. 4. This peculiar position of the guide-rolls M M' is determined by the fact that the driving-pulley E laterally bends or curves the friction-belt F somewhat more at the higher edge thereof, whereby the belt is caused to assume a form which requires compensation by the above-described arrangement of the guide-rolls M M', in order to produce a uniform tension throughout the width of the belt and to maintain the latter in a self-guiding condition.

The most advantageous position of the

guide-rolls M M' is best obtained by carrying the shaft N of the upper guide-roll M in an adjustable support J, Figs. 1, 2, and 3, capable of being turned about a standard P, which support by trial is adjusted to and fixed in the position in which the belt F shows no tendency to shift laterally, while the lower roll M', the shaft N' of which is carried in the rotatable fork I, can freely turn to any extent, Figs. 1, 2, 3, and 6, follows the form of the belt F to any position which it may assume or which may be desirable. I have also found it desirable and advantageous to make the guide-rolls M M' for the friction-belt F either of a width corresponding to the frictional surfaces of the friction-pulleys E D or to make them narrow and mount the same free to shift laterally with the shifting of the belt between the friction-pulleys. In the first case the belt will shift laterally on the guide-rolls, while in the latter case the guide-rolls follow the lateral movement of the belt. Lastly, in order to meet the condition that the belt must have absolutely the same speed at its two edges or at any two points of its surface that are at equal lateral distances from the center line of the belt, if it is to be really self-guiding; that is to say, if it is to have no inherent tendency to shift laterally between the pulleys, (which is entirely dependent upon the correct relative proportion of the diameters of the pulleys D and E,) it is necessary that the pulleys D and E shall have diameters of a perfectly definite size, as shown in Fig. 7; namely, that the end diameters of the conical male driving-pulley E and those of the conical female driven pulley D shall have a definite ratio. Referring to said figure the end diameters $a b$ and $c d$ must have the same ratio to each other as the end diameters $e f$ and $g h$ of the driven pulley D, or, in other words, the diameters $a b$ and $e f$ of the two pulleys must have the same ratio as the diameters $c d$ and $g h$ thereof.

What I claim as new is—

1. A variable-speed friction-gear for shafts placed at an angle, consisting of two pulleys, the conical coöperating faces of which are respectively convex and concave, a friction-belt separately mounted and having its driving side placed between said coöperating faces and embracing the driving-pulley sufficiently to maintain the said belt in continuous contact with said driving-pulley when the driving and driven pulleys are disengaged, for the purpose of continuing the motion of said belt, and means for forcing the pulleys together, substantially as described.

2. A variable-speed friction-gear for shafts placed at an angle, consisting of two pulleys, the conical coöperating faces of which are respectively convex and concave, guide-rolls, a friction-belt placed about said guide-rolls and having its driving side placed between the said coöperating faces and embracing the driving-pulley sufficiently to maintain the said belt in continuous contact with said

driving-pulley when the driving and driven pulleys are disengaged, for the purpose of continuing the motion of said belt, and means for forcing the pulleys together, substantially as described.

3. A variable-speed friction-gear for shafts placed at an angle, consisting of two pulleys, the one being a conical male pulley, and the other a conical female pulley, the respective faces of which are convex and concave, a friction-belt placed between said cooperating faces, separate guide-rolls located above and below the driving-pulley and overlapping the same for supporting the belt and for conducting the same around a sufficient portion of the periphery of the driving-pulley to maintain the said belt in motion by its contact with said pulley when the pulleys are disengaged, and means for forcing the pulleys together, substantially as and for the purpose set forth.

4. A variable-speed friction-gear for shafts placed at an angle, consisting of two conical

pulleys, a friction-belt placed between said pulleys, a lower guide-roll for the friction-belt mounted to move freely both in the longitudinal direction of the belt and laterally with respect to the same, means for producing tension in the belt, an upper guide-roll for the belt hinged to turn laterally, and means for securing the latter roll, substantially as and for the purpose set forth.

5. A variable-speed friction-gear for shafts placed at an angle, consisting of two pulleys, a friction-belt placed between said pulleys, a lower guide-roll for the belt, and an upper guide-roll mounted to turn laterally, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHRISTIAN SEYBOLD.

Witnesses:

FREDRICH CORRELL,
MICHAEL ZIMMERMANN.