No. 803,810. PATENTED NOV. 7, 1905.

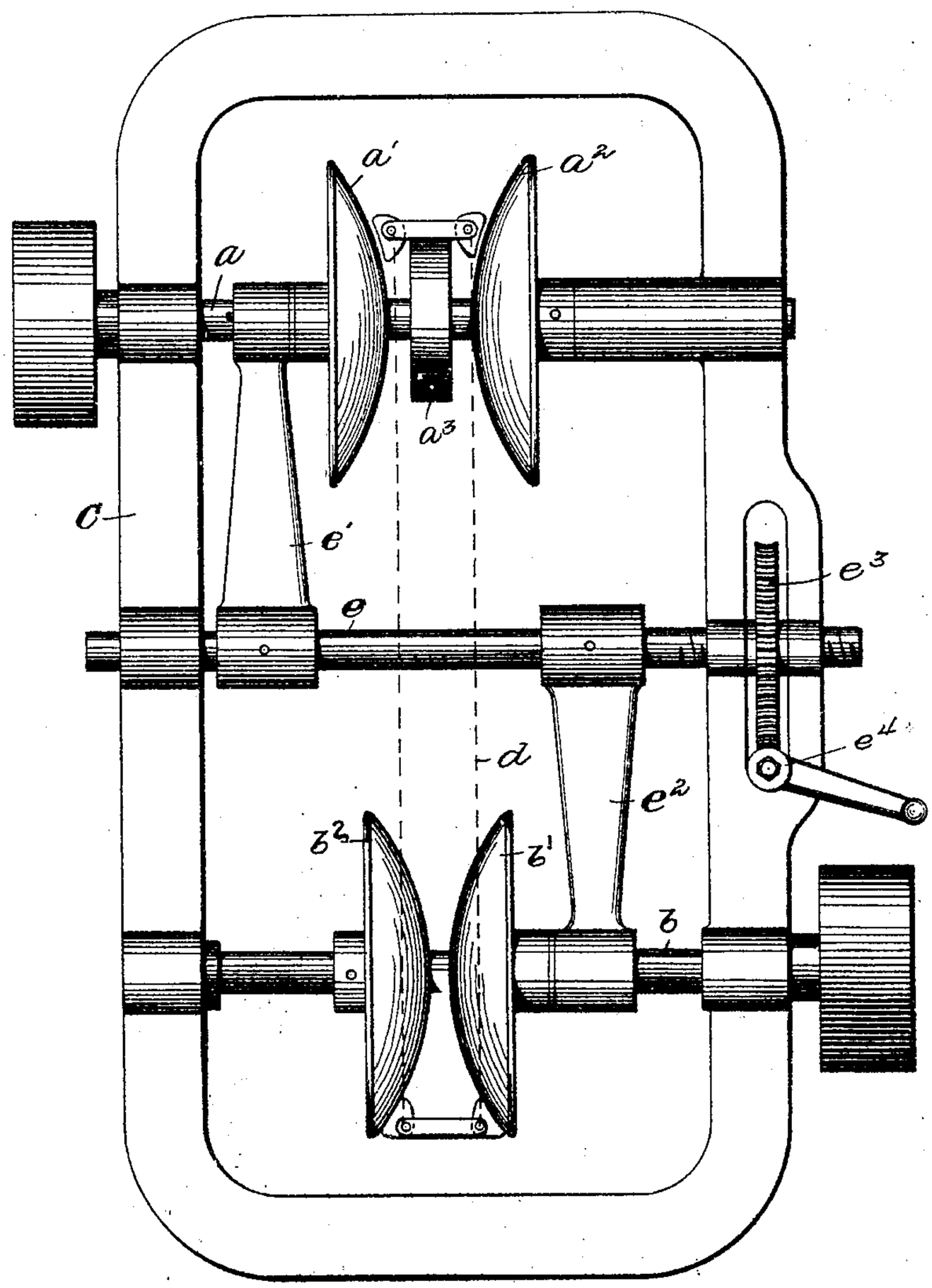
G. A. CUTTER.

SPEED CHANGING DEVICE.

APPLICATION FILED JUNE 24, 1903.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2

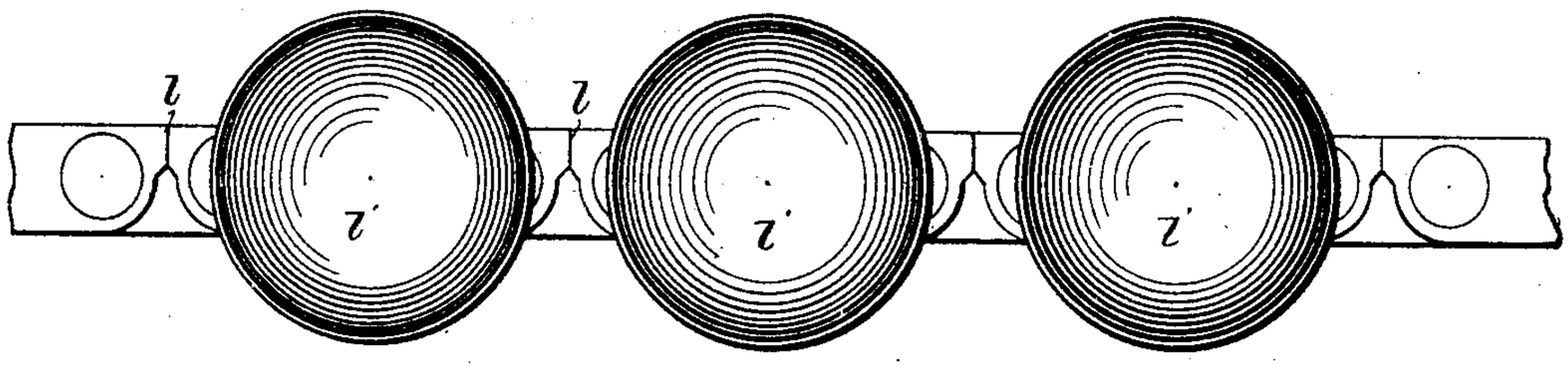


Fig. 3

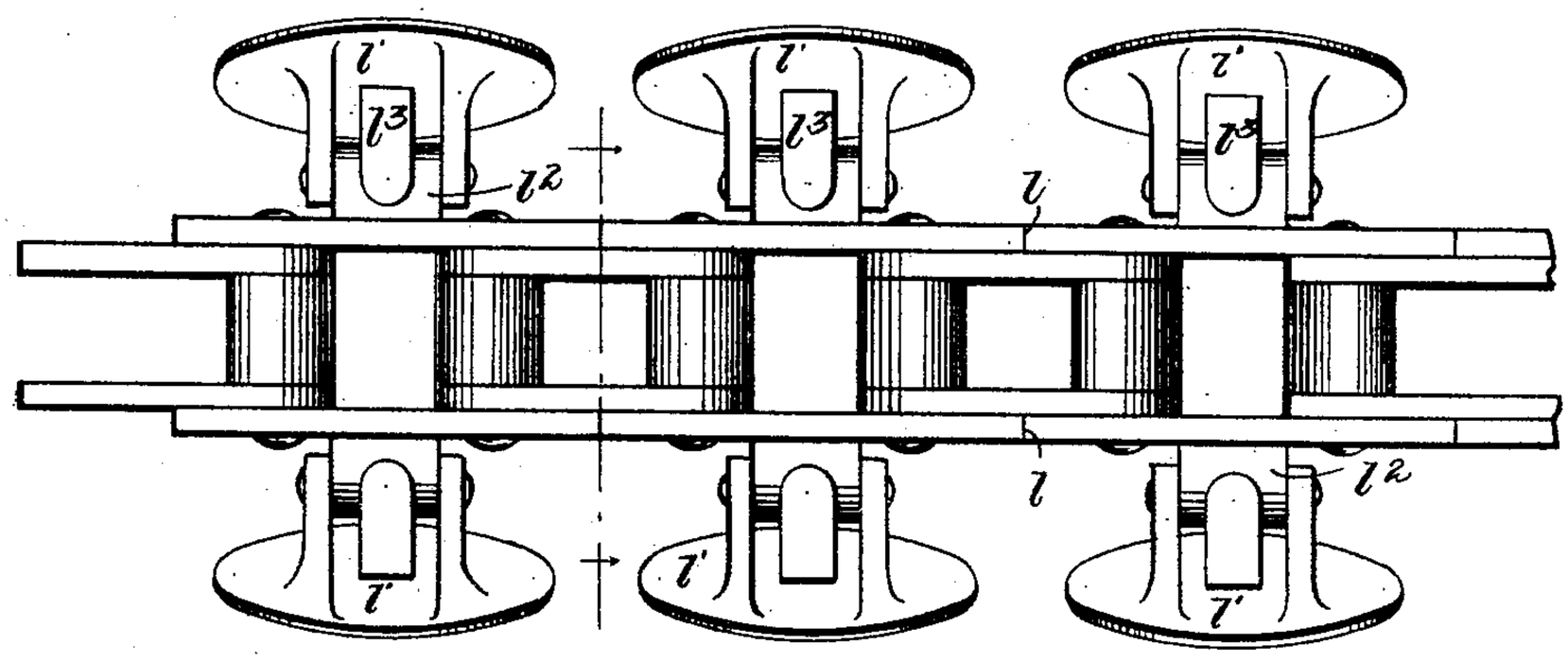
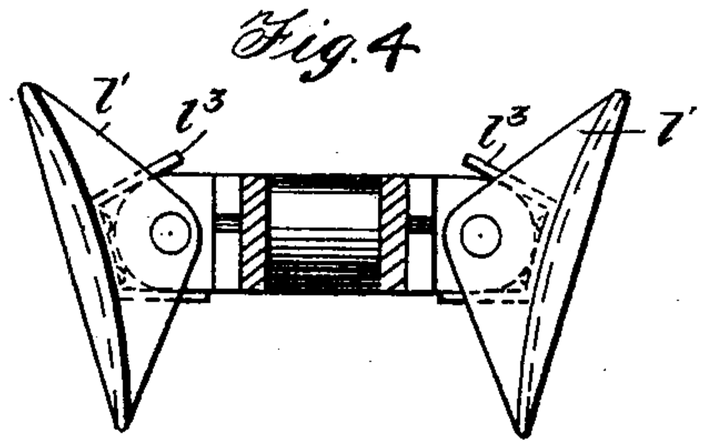


Fig. 4



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4 SHEETS—SHEET 3.

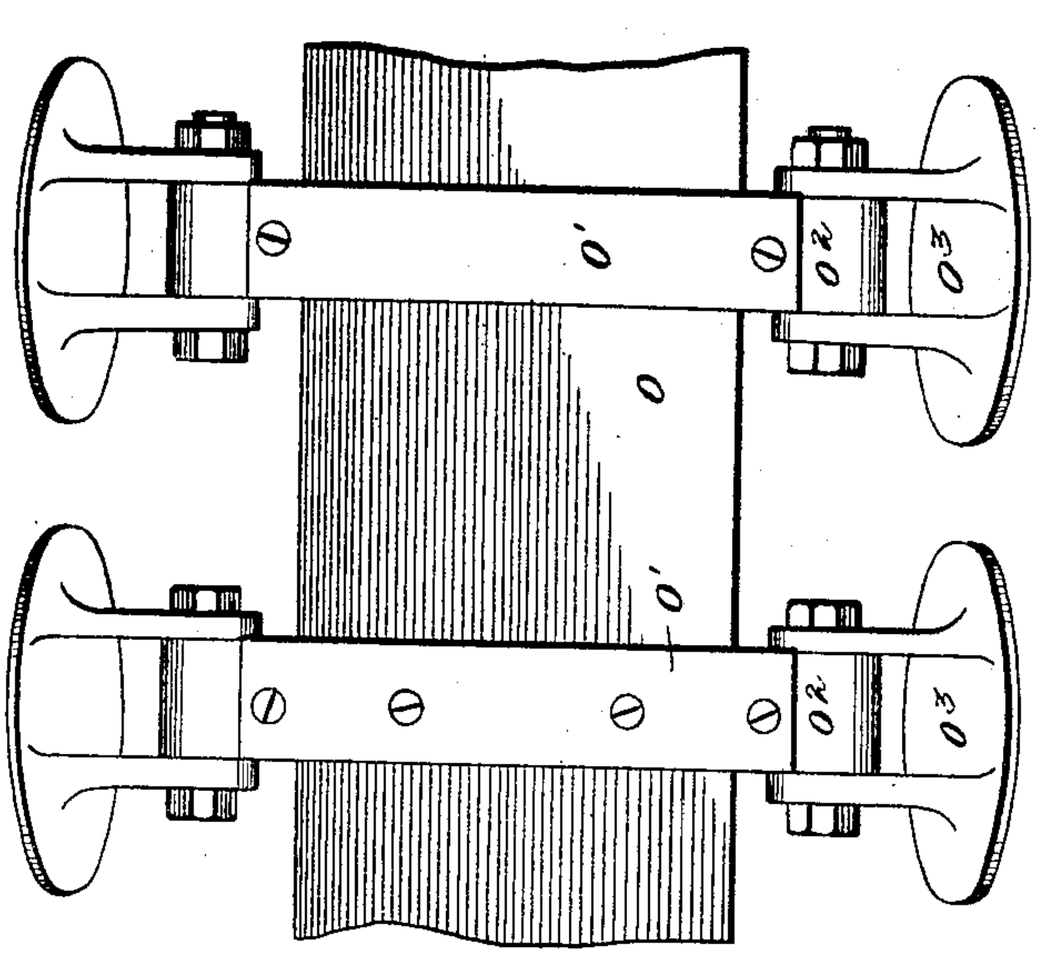

Fig. 5

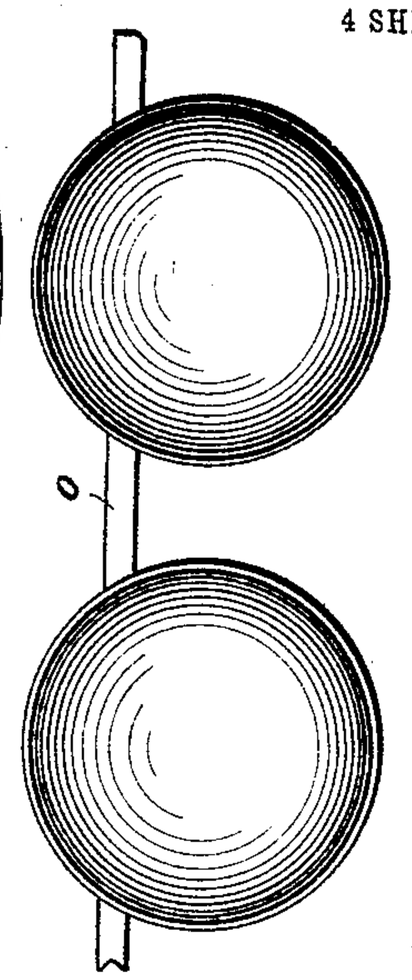

Fig. 6

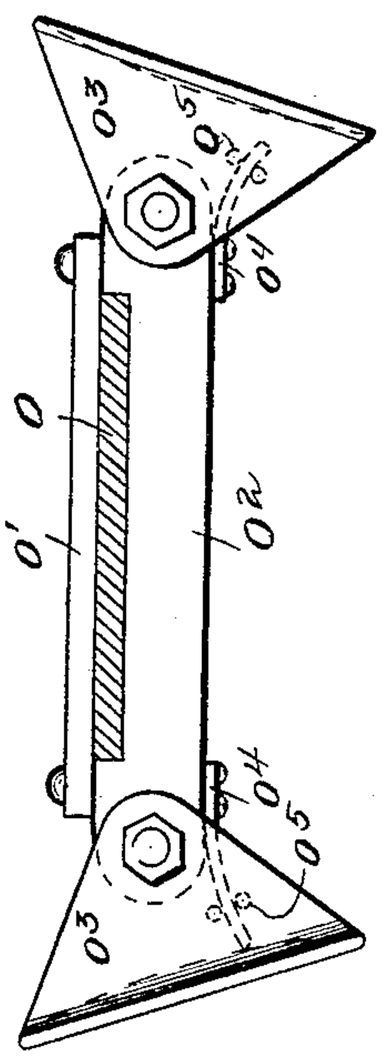

Fig. 7

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No. 803,810. PATENTED NOV. 7, 1905.

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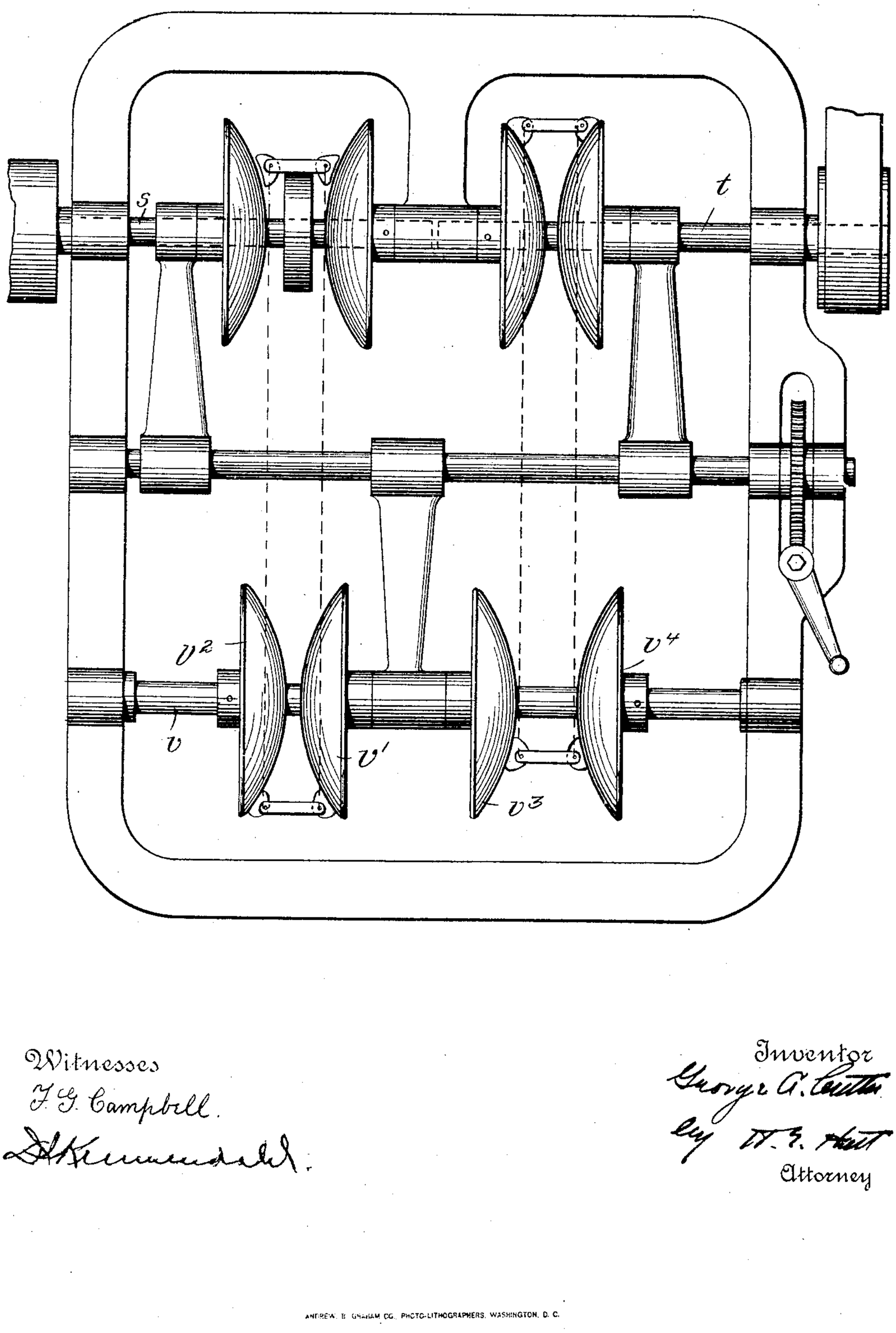
APPLICATION FILED JUNE 24, 1903.

4 SHEETS—SHEET 4.

Fig. 8.



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UNITED STATES PATENT OFFICE.

GEORGE A. CUTTER, OF NASHUA, NEW HAMPSHIRE.

SPEED-CHANGING DEVICE.

No. 803,810. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed June 24, 1903. Serial No. 162,955.

To all whom it may concern:

Be it known that I, GEORGE A. CUTTER, a citizen of the United States of America, residing at Nashua, in the county of Hillsboro and State of New Hampshire, have invented certain new and useful Improvements in Speed-Changing Devices, of which the following is a specification.

The object of this invention is to produce devices of the general character herein described having features of novelty and advantage.

Referring to the drawings, Figure 1 is a general plan view of an embodiment of my invention. Fig. 2 is a detail edge view of the belt. Fig. 3 is a detail plan view of the belt. Fig. 4 is a cross-sectional view of the belt. Fig. 5 is a plan view of a modified form of belt. Fig. 6 is an edge view of the same. Fig. 7 is a cross-sectional view of the same. Fig. 8 is a general view of an embodiment of my invention permitting double reduction or increase.

The general features of the construction and operation of a device made according to my invention are illustrated in Fig. 1; wherein a b are the two shafts, suitably supported, from one of which, as a, it is desired to transmit power to the other, b, and provide for varying the speed of the shaft b, while that of the shaft a is constant. For the purposes of a simple illustration of the invention these two shafts are shown as mounted in the frame c; but it will be readily understood that the application of my invention to practical uses is not confined to such a structure as is illustrated. On the shaft a are mounted the two disks a' a^2. The disk a' is keyed to the shaft, but is free to slide thereon toward and away from the disk a^2. The disk a^2 is keyed and pinned to the shaft so that it cannot be moved in any manner relatively thereto. On the shaft b are mounted the disks b' b^2, the disk b' being keyed to the shaft, but adapted for movement lengthwise thereof toward and away from the disk b^2, while the disk b^2 is both keyed and pinned to the shaft, so that it is not movable with respect thereto. The disks a' a^2 on the shaft a and b' b^2 on the shaft b constitute a peculiar form of driving-pulley, the center line between one pair of disks being coincident with the center line between the other pair of disks, the pair of disks being connected by a suitable belt, as indicated at d. It will be seen from the drawings that the fast disk a^2 on the shaft a is diagonally opposite the fast disk b^2 on the shaft b, their active surfaces facing one another, and that the loose disks a' b' have the same relative positions with respect to one another as do the disks a^2 b^2. A rod e is mounted to move across the frame c and has secured to it the arms e' e^2, which butt against and may be secured to the heads of the movable disks a' b'. Means, as the worm-wheel and pinion e^3 e^4, are provided for moving the rod e^2 back and forth. It will be seen when this rod moves to the left the disk b' is moved toward the disk b^2 and the disk a' is moved away from the disk a^2 and that when the rod e is moved in the opposite direction a' is moved toward a^2 and b' away from b^2. A suitable belt passes around the two pulleys formed by the disks, it being provided on its edges with active faces which engage the surfaces of the disks, which will be more clearly described hereinafter. The opposing surfaces of the disks are spherically convex, as shown. Assuming that a is the driving-shaft and b the driven shaft, it is evident that when the distance between the disks a' a^2 b' b^2 is the same the two shafts will be driven at the same speed, but that when the disk a' is moved toward or away from the disk a^2 the shaft b will be driven at a faster or slower rate of speed than is the shaft a. It will be seen that as the position of the belt changes in moving toward the larger diameter of one pair of disks and the smaller diameter of the other pair its line of travel is shifted from left to right, owing to the fact that one disk on each shaft is stationary with respect to the shaft. Between the disks a' a^2 I locate a wheel or pulley a^3, which is loosely mounted upon the shaft a. When the disk a' is moved away from the disk a^2 to a certain extent, the belt will rest upon the wheel a^3, its active faces being disengaged from the disks a' a^2, and under these conditions the driving connections between the shafts a and b is interrupted, permitting the shaft b to remain idle during the rotation of the driving-shaft a. This is the position of the parts as illustrated in Fig. 1. This pulley, in connection with the disks and belt, furnishes a very efficient friction-clutch, it being adapted for use to start a machine at its slowest speed from a continuously-running shaft and to increase its speed gradually, as desired.

For use in connection with a device of this kind I have produced a novel form of belt, which has many advantageous features. Re-

ferring to Figs. 2, 3, and 4, it will be seen that the belt therein illustrated is in general of the form of an ordinary sprocket-chain. As seen in Fig. 3, the side links for a certain part of their depth are butted together, as at l, which prevents its bending in one direction and allows of its bending in the other direction. This feature prevents the sagging of the chain in its travel from top of one pulley to the top of the other. To the side links are pivoted shoes l', whose faces are shaped to fit closely upon the active surfaces of the driving-disks. As illustrated, these surfaces are of a spherically-concave form adapted to fit on the spherically-convex disks. (Shown in Fig. 1.) The pivot of these shoes and the shaping of their active faces permits them readily to accommodate themselves to such a position with respect to the driving-disks that the most intimate and firm driving contact is obtained. As shown in Fig. 3, these shoes l' are pivoted to lugs l^2, formed on the side links, and they are held in position and against rattling by springs l^3.

In the modified form of belt shown in Figs. 5, 6, and 7 I employ an ordinary flat belt o, to which is secured at intervals the strips o' o^2, at the ends of which I pivot the shoes o^3, holding them in position by the springs o^4, the free ends of which are positioned by the pins o^5. In other respects the belt and its mode of operation is similar to that shown in Figs. 2, 3, and 4.

Fig. 8 shows a duplication of Fig. 1, wherein s may be considered the driving-shaft and t the driven shaft; v, an intermediate shaft between the two, which shaft is provided with suitable disks, one of each pair being fast to the shaft and the other keyed to, but movable lengthwise thereof. On the shaft v the fast disks v^2 v^4 are opposed to one another and the movable disks v' v^3 are preferably connected to a single shifting-lever in such manner that when one is moved toward its coacting disk the other is moved away from its coacting disk. It will be seen that the reduction or increase between s and t is by this arrangement doubled. An advantageous feature which is obtained by my construction which permits of this double reduction is that the end thrust on the disk o^2 is balanced by that on the disk v^4, the same being true of the movable disks v' v^3, thus relieving the mechanism and its supports when used in this manner from any undue strain.

I claim as my invention—

1. A speed-varying device comprising expansible pulleys having spherically-convex active faces, the shafts on which said pulleys are mounted, and the belt connecting said pulleys, substantially as described.

2. A speed-varying device comprising expansible pulleys having spherically-convex active faces, the shafts on which said pulleys are mounted, the belt connecting said pulleys, and means for expanding and contracting said pulleys whereby the driving diameters are increased and diminished.

3. A speed-varying device comprising expansible pulleys having spherically-convex active faces, the shafts on which said pulleys are mounted, and the belt connecting said pulleys having cup-shaped contact-surfaces whose curvature is the same as the curvature of said disks.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE A. CUTTER.

Witnesses:
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L. F. PEASE.