No. 703,261. Patented June 24, 1902.

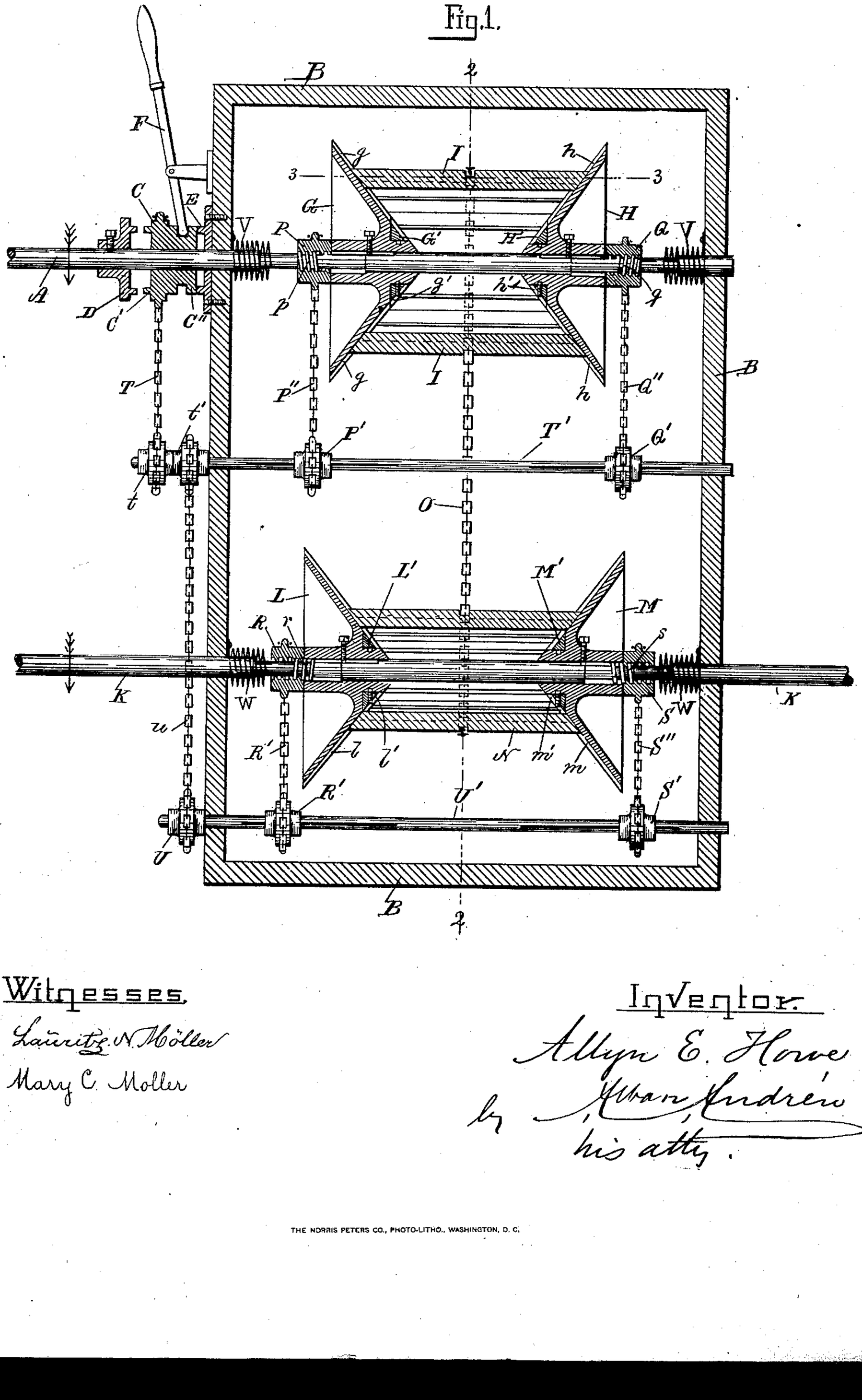
A. E. HOWE.

SPEED REGULATOR FOR ROTARY SHAFTS.

(Application filed Mar. 3, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses.

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Fig. 2

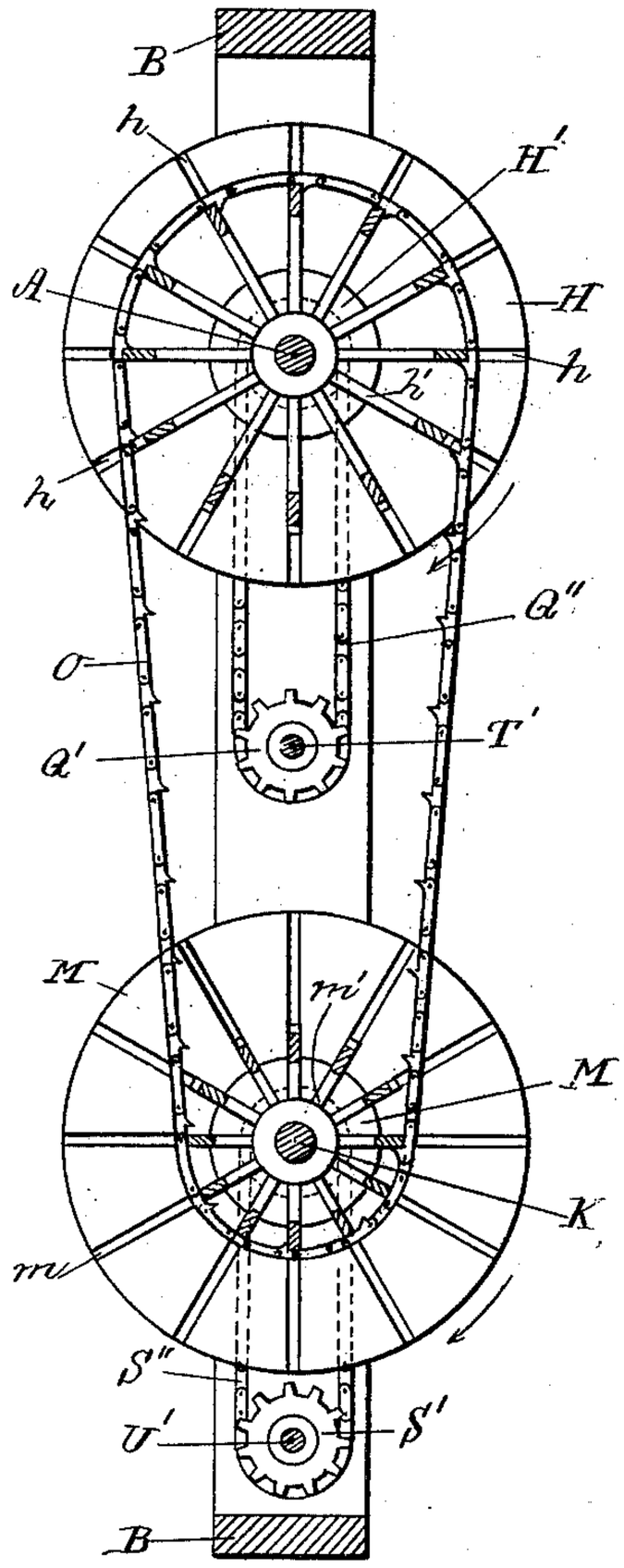
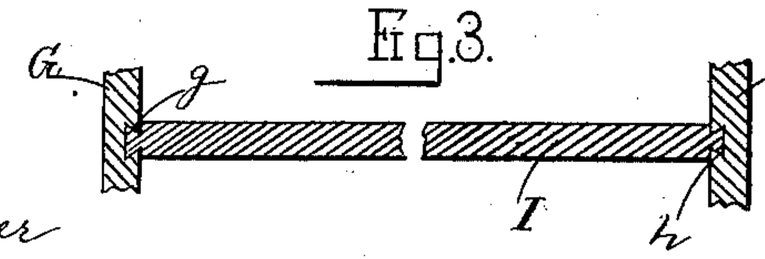


Fig. 3.



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UNITED STATES PATENT OFFICE.

ALLYN E. HOWE, OF NEW YORK, N. Y.

SPEED-REGULATOR FOR ROTARY SHAFTS.

SPECIFICATION forming part of Letters Patent No. 703,261, dated June 24, 1902.

Application filed March 3, 1902. Serial No. 96,400. (No model.)

To all whom it may concern:

Be it known that I, ALLYN E. HOWE, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Speed-Regulators for Rotary Shafts, of which the following is a specification.

This invention relates to improvements in speed-regulators for rotary-driven shafts, and it is particularly well adapted for use on automobiles, although it may to equal advantage be used on machines in connection with rotary motor-shafts the speed of which is to be regulated.

The invention is carried out as follows, reference being had to the accompanying drawings, wherein—

Figure 1 is a top plan view of the invention, partly shown in section. Fig. 2 is a cross-section on the line 2 2 shown in Fig. 1, and Fig. 3 is a detail sectional view of one of the radially-movable bars on the grooved cones of the speed-regulator.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

In the drawings, A represents the rotary driver-shaft of a motor of any kind or construction. Said shaft is journaled in bearings in a suitable frame B, as shown.

On the rotary driver-shaft A is loosely journaled a sprocket-wheel C, provided with clutch-surfaces C′ and C″ on its opposite sides, adapted to engage, respectively, with the clutch D, secured to the shaft A, and a stationary clutch E, secured to the side of the frame B, as shown in Fig. 1. The sprocket-wheel C is longitudinally adjustable on the shaft A for the purpose of causing its clutch-surfaces to be alternately connected to the clutches D and E, and I have for this purpose shown said sprocket-wheel C provided with an annular grooved hub, connected to a hand-lever F, which is pivoted at *f*, as is common in clutch-operating devices.

On the shaft A are located a pair of cone-disks G H, which are splined on said shaft, so as to rotate with said shaft, while they are longitudinally movable thereon to and from each other, as shown in Fig. 1. The said cone-disks G H are provided on their faces with radial grooves *g h*, preferably dovetailed in section, in which grooves are radially movable the correspondingly-shaped ends of the bars I I I, as shown.

Upon the inner ends of the respective cone-disks G H are loosely journaled the cones G′ H′, which are provided with radial grooves *g′ h′*, made of sectional shape, like the grooves *g h*, for the reception of the ends of the bars I I, as shown.

The cones G′ H′ are loosely journaled upon the inner ends of the respective cones G H, but are suitably connected, respectively, to the latter, so as to partake of their longitudinal movement on the shaft A, as shown in Fig. 1. In practice I prefer for this purpose to make a circumferential groove on the hubs of the inner ends of the cones G H, adapted to receive a pin or projection attached to the loosely-connected cones G′ H′, as shown in Fig. 1. I do not wish to limit myself to any particular manner of thus connecting the cones G′ H′ to the respective cones G H, it being only essential that the cones G′ H′ shall be loosely journaled relative to the cones G H, but connected to the latter, so as to move longitudinally with them on the shaft A.

In bearings in the frame B is journaled the ends of the driven shaft K, to the ends of which may be secured the wheels of the vehicle if the device is used on an automobile. On said shaft K are located a pair of cones L M, which are splined on the shaft K, while they are longitudinally movable thereon in a manner like the cones G H on the driver-shaft A, hereinabove described.

On the inner ends of the cones L M are loosely journaled the small cones L′ M′ in a manner similar to the cones G′ H′ on the cones G H, as hereinbefore shown and described.

l m and *l′ m′* are radial grooves on the cones L M L′ M′ for the reception of the ends of the bars N N N, similar in construction to the bars I I I on the cones G H G′ H′, as shown.

O is an endless chain running around the radially-adjustable bars I N, as shown in Figs. 1 and 2, and by such endless chain a rotary motion is imparted from the driver-shaft A to the driven shaft K with a variable

velocity of the latter, according to the radial positions of the bars I N relative to their respective cones G H and L M.

On the shaft A are made screw-threads *p q*, the former being a right-hand screw and the latter a left-hand one, as shown. Such screw-threads engage, respectively, the internally correspondingly screw-threaded sprocket-wheels P Q, located on the shaft A, as shown.

On the driven shaft K are made screw-threads *r s*, the former being a left-hand screw and the latter a right-hand one, as shown. Such screw-threads engage, respectively, the internally correspondingly screw-threaded sprocket-wheels R S, located on the shaft K, as shown.

From sprocket-wheel C leads a chain T to a smaller sprocket-wheel *t*, secured to a counter-shaft T', journaled in bearings in the frame B, as shown. To said shaft T' is secured a sprocket-wheel *t'* of a diameter equal to the sprocket-wheel *t*, which latter is about half as large as the sprocket-wheel C on the shaft A, as shown. From the sprocket-wheel *t'* leads a sprocket-chain *u* to a similar size sprocket-wheel U, secured to a counter-shaft U', journaled in bearings in the frame B, as shown. On the counter-shaft T' are splined the longitudinally-movable sprocket-wheels P' Q', which are connected, respectively, to the sprocket-wheels P Q by means of the respective endless chains P'' Q'', as shown. In a similar manner upon the counter-shaft U' are splined and longitudinally adjustable the respective sprocket-wheels R' S', which are connected, respectively, to the sprocket-wheels R S by means of the respective sprocket-chains R'' S'', as shown.

In practice all the sprocket-wheels *t t'* P' Q' U' R' S' and R S P Q are made of equal diameters; but the sprocket-wheel C on the driver-shaft A is made somewhat increased in diameter as compared with the others, and in practice I make the said sprocket-wheel C twice as large in diameter relative to each of the above ones mentioned.

Upon the shaft A adjacent to the inner portions of the frame I locate compressible coiled springs V V, which are secured in one of their ends to the frame B in any suitable manner. W W are similar springs on the axle K, secured in one of their ends to the frame B for a purpose as will hereinafter be described.

It will be noticed that when the grooved cones G H are approaching each other on the rotary shaft A they cause the bars I I to move outward in the grooves in said cones, and during such operation the endless chain O causes the bars N N on the cones L M, located on the shaft K, to move inward from each other on said shaft, by which a reduced speed of rotation is imparted to the shaft K from the driver-shaft A, and vice versa.

The operation of the speed-regulator is as follows: During the rotation of the driver-shaft A in the direction as shown a rotary motion is imparted to the cones G H, which are splined upon and longitudinally movable on said shaft, and by means of the bars I I and the endless chain O a rotary motion is imparted to the bars N N and the cones L M, which are splined upon and longitudinally movable on the shaft K, by which arrangement the latter shaft is set in rotation. If it is desired to decrease the speed on the shaft K, I move the sprocket-wheel C toward the frame B, so that it will be held stationary by the interlocking of the clutches C'' and E, as shown in Fig. 1. The now stationary sprocket-wheel C being connected by the intermediate chains and shafts T' U' will thus cause the screw-threaded sprocket-wheels P Q on the shaft A, as well as the sprocket-wheels R S on the shaft K, to be held from rotation. During such stationary position of the sprocket-wheels P Q during the rotation of the shaft A the sprocket-wheels P Q will be moved outward on said shaft A on account of their being internally screw-threaded. As a rotary motion is imparted to the lower cones L M by means of the endless chain O the screw-threaded sprocket-wheels R S will be caused to move toward each other on the shaft K, causing the cones L M to move toward each other, by which their bars N N will expand radially, and the endless chain O will thus contract the bars I, thereby causing the cones G H to be forced away from each other, thereby causing the speed of the shaft K to be decreased as compared with the speed of the driver-shaft A. If it is desired to increase the speed of the shaft K, I move the sprocket-wheel C on the shaft A until it interlocks with the clutch D on the shaft A, causing the sprocket-wheel C to rotate with the shaft A, and by the connecting mechanism to the internally-screw-threaded sprocket-wheels P Q R S said sprocket-wheels are caused to rotate faster than the shaft A, thereby causing the sprocket-wheels P Q to move toward each other, by which the cones G H will be moved inward, thereby forcing outward or expanding the bars I I. At the same time the sprocket-wheels R S will move outward on the shaft K. The endless chain O, running on the now expanded bars I I, will cause the bars N N to contract, thus forcing the cones L M outward, and as the radii of the bars I are at this time greater than the radii of the lower bars N an increased speed will be given to the shaft K. To again decrease the speed of the shaft K relative to the driving-shaft A, I move the sprocket-wheel C on the shaft A until it interlocks with the stationary clutch E, causing the internally-screw-threaded sprocket-wheels P Q R S to be held from rotation, thereby causing the screw-threaded sprocket-wheels P Q to move away from each other on the shaft A, and as a rotary motion is imparted by the chain O from the cones G H to the cones L M the latter are rotated and forced toward each other

by the screw-threaded sprocket-wheels R S, the bars N N on the cones L M are radially moved outward, while at the same time the bars I I on the cones G H are moved inward a corresponding reduced speed is imparted from the shaft A to the shaft K. For the purpose of limiting the radial adjustment of the bars I I on the cones G H and the bars N N on the cones L M, so as to prevent the shaft K from rotating too rapidly or too slowly, I make use of the secondary grooved cones G′ H′, loose on the cones G H, and grooved cones L′ M′, loose on the cones L M, as hereinabove described, and it will be noticed that if the bars I I should be caused to move outward on the cones G H to the limit of thereon the bars N N will be moved inward, so as to engage into the grooves on the loosely-rotating small cones L′ M′, thus preventing the shaft K from further rotation until the position of the sprocket-wheel C on the driving-shaft A is reversed. In a like manner during the reducing of the speed of the shaft K when the bars N N are moved outward on the cones L M to their limit the bars I I on the cones G H will be moved inward, so as to engage the grooves on the loosely-rotating small cones G′ H′, thus preventing any rotation of the shaft K from the driving-shaft A until the position of the sprocket-wheel C on the driving-shaft A is reversed.

On opposite ends of the screws *p q* on the shaft A are made reduced portions, as shown in Fig. 1, so as to prevent engagement of the internally-screw-threaded sprocket-wheels P Q with the screws on the shaft A when said sprocket-wheels reach the limits of their outer and inner positions on the said shaft A, thus preventing any longitudinal feed of the cones G H when said sprocket-wheels reach their extreme positions in either direction on the shaft A. In a like manner and for a similar purpose reduced portions are made on the shaft K on opposite ends of the screw *r s*, as shown.

The springs V V on the shaft A serve for the purpose of automatically causing the screw-threaded sprocket-wheels P Q to engage the screws *p q* on the shaft A when the cones G H are moved to their outward positions subsequent to the reversal of the position of the sprocket-wheel C on the shaft A, as shown. The springs W W on the shaft K serve in a similar manner to cause the screw-threaded sprocket-wheels R S to engage the screws *r s* subsequent to the reversal of the position of the sprocket-wheel C on the shaft A when the cones L M are moved to their outward positions on the shaft K.

It will thus be seen that the speed imparted to the shaft K from the shaft A is regulated by the longitudinally-adjustable grooved cones G H on the shaft A, having radially-adjustable bars I I and endless chain O, engaging said bars I I, and the radially-adjustable bars N N, working in the grooves of the longitudinally-movable cones L M on the shaft K, as hereinabove described.

What I wish to secure by Letters Patent and claim is—

1. The herein-described speed-regulator, for rotary shafts, consisting of a rotary driver-shaft A, longitudinally-movable and radially-grooved cones G, H, splined on said shaft, sprocket-wheels P, Q, engaging right and left screw-threads on said shaft, radially-adjustable bars I, I movable in the said grooved cones, a shaft K, longitudinally-adjustable grooved cones L, M splined on said shaft, bars N, N engaging said cones, an endless sprocket-chain engaging said bars I, I, N, N, sprocket-wheels R, S, engaging left and right screw-threads on said shaft K, and intermediate connecting mechanism from said driver-shaft A, to said sprocket-wheels on the shafts A and K, substantially as and for the purpose set forth.

2. The rotary speed-regulator, as described, consisting of a rotary driver-shaft and a rotary driven shaft, a pair of longitudinally-adjustable and radially-grooved cones splined on each of said shafts, bars adjustable in said grooved cones, an endless chain engaging said bars internally-screw-threaded right and left sprocket-wheels working on corresponding screw-threaded portions of said shafts, a sprocket-wheel on the driving-shaft, a sprocket-chain connecting said sprocket-wheel to said pair of sprocket-wheels, and clutch mechanism on the latter for regulating the speed imparted from the shaft A, to the shaft K, substantially as herein set forth and described.

3. In a rotary speed-regulator, in combination a rotary driver-shaft, and a rotary driven shaft, a pair of longitudinally-movable grooved cones splined upon each of said shafts, bars adjustable in said grooved cones, an endless chain, connecting said bars, internally-screw-threaded sprocket-wheels engaging screws on said shaft, an adjustable sprocket-wheel connected to the sprocket-wheels on the driver-shaft and loosely-rotating grooved cones G′, H′, L′, M′, arranged respectively on the cones G, H, and L, M, substantially as and for the purpose set forth.

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

ALLYN E. HOWE.

Witnesses:
ALBAN ANDRÉN,
CHARLES A. KEIHAM.