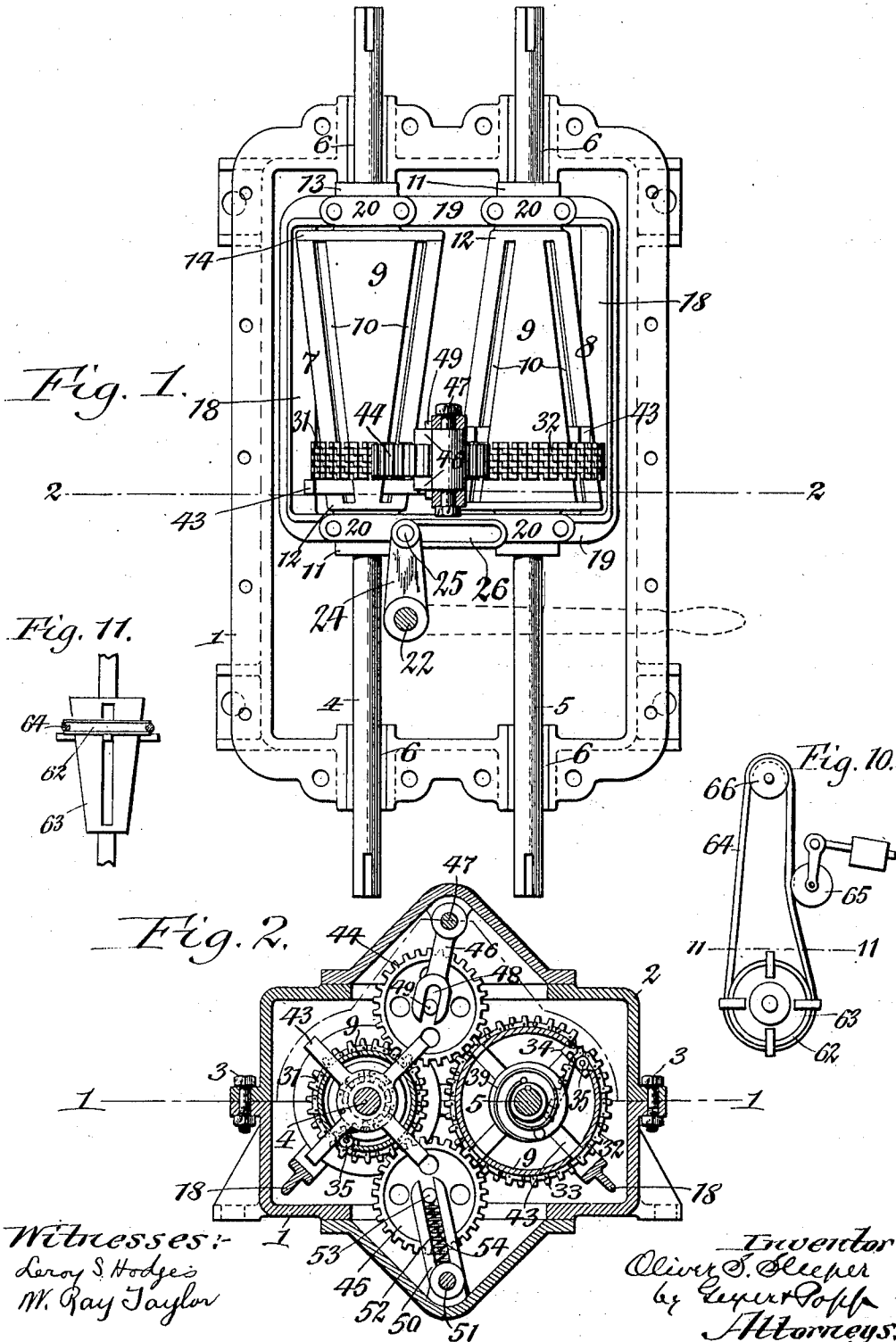


O. S. SLEEPER.
SPEED CHANGING MECHANISM.
APPLICATION FILED FEB. 5, 1912.

1,048,220.

Patented Dec. 24, 1912.

3 SHEETS—SHEET 1.



Witnesses:
Leroy S. Hodges
W. Ray Taylor

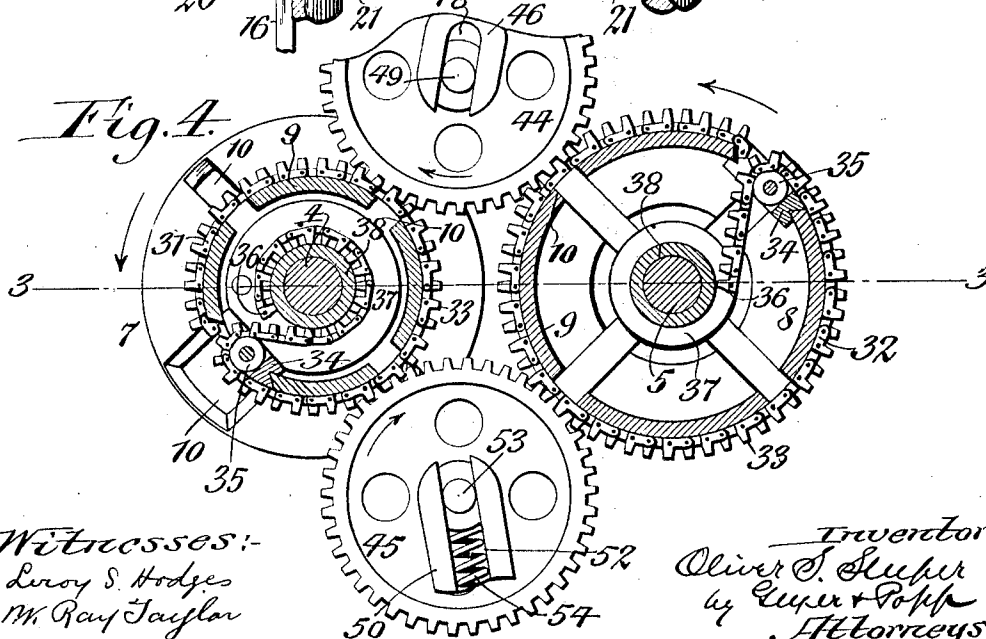
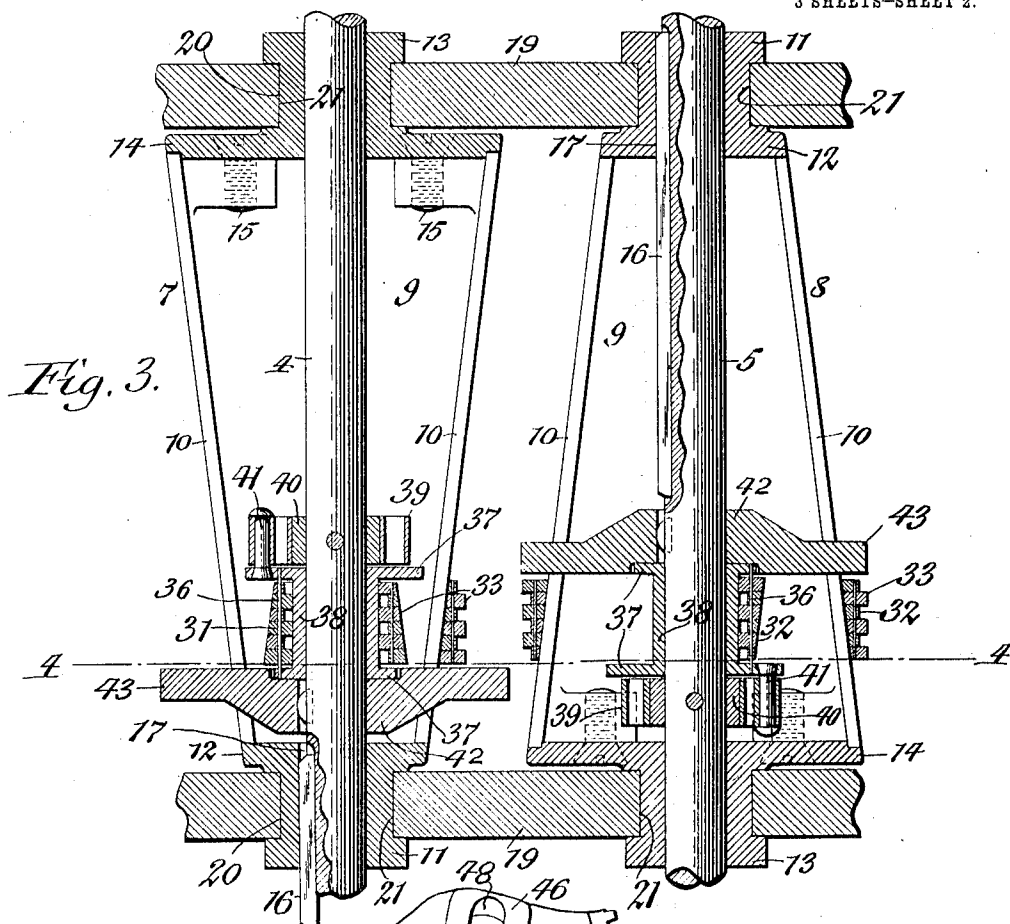
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3 SHEETS—SHEET 2.



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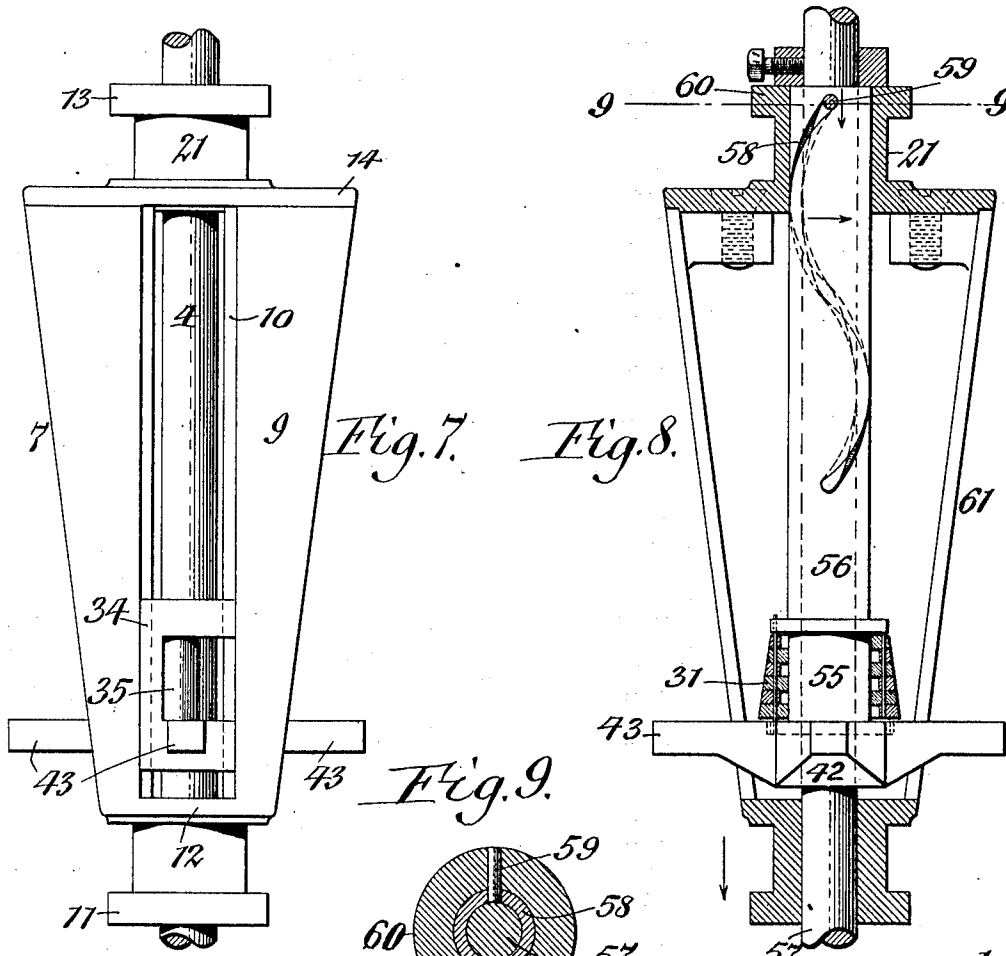
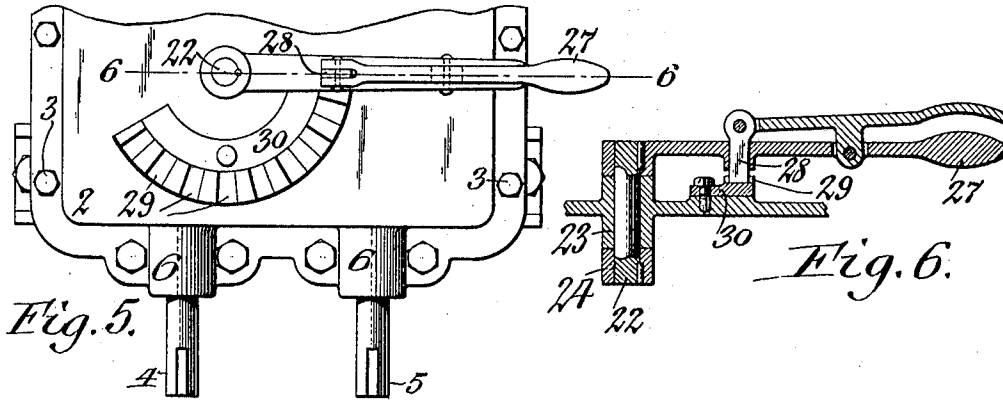
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3 SHEETS-SHEET 3.



Leroy S. Hodges
Mr. Ray Taylor

Witnesses.

Inventor
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by Super & Tapp
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UNITED STATES PATENT OFFICE.

OLIVER S. SLEEPER, OF BUFFALO, NEW YORK.

SPEED-CHANGING MECHANISM.

1,048,220.

Specification of Letters Patent.

Patented Dec. 24, 1912.

Application filed February 5, 1912. Serial No. 675,510.

To all whom it may concern:

Be it known that I, OLIVER S. SLEEPER, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Speed-Changing Mechanism, of which the following is a specification.

This invention relates to a speed changing mechanism or gearing which may be employed in connection with various kinds of machinery or vehicles in which a variation in the speed between the driving and driven members is required.

It is the object of this invention to provide a gearing of this character which permits of the greatest possible variations in speed between the driving and driven members within predetermined limits; which can be adjusted to vary the speed without disengaging any gearing and without stopping the machine; and which is comparatively noiseless, easily operable and not liable to get out of order.

In the accompanying drawings consisting of 3 sheets: Figure 1 is a horizontal section taken in line 1—1, Fig. 2 and showing a speed changing gearing embodying one form of my invention. Fig. 2 is a vertical transverse section in line 2—2, Fig. 1. Fig. 3 is a fragmentary horizontal section, on an enlarged scale, taken in line 3—3, Fig. 4. Fig. 4 is a fragmentary vertical transverse section taken in line 4—4, Fig. 3. Fig. 5 is a fragmentary top plan view of the gearing. Fig. 6 is a fragmentary vertical transverse section taken in line 6—6, Fig. 5. Fig. 7 is a detached top plan view of one of the cone drums, pulleys or drums and adjacent parts of the gearing. Fig. 8 is a sectional top plan view of one of said cone pulleys or drums showing a modification of my invention. Fig. 9 is a vertical transverse section in the correspondingly numbered lines in Fig. 8. Fig. 10 is an end elevation showing another modified form of my invention. Fig. 11 is a horizontal section in line 11—11, Fig. 10.

Similar characters of reference indicate corresponding parts throughout the several views.

The main frame which supports the working parts of the chain speed gearing may be variously constructed but as shown in the drawings the same preferably is constructed

in the form of an inclosing casing or housing which covers the working parts of the gearing and which comprises a lower section 1, an upper section 2 and means for detachably connecting these two sections at the joint which is located about midway of the height of the casing. This detachable connection may consist of bolts 3 passing through corresponding flanges on the upper and lower housing sections, as shown in Figs. 2 and 5, or any other suitable means may be provided for this purpose.

4, 5 represent two longitudinal shafts which are arranged horizontally and parallel within the casing and journaled at opposite ends in bearings 6 which are preferably arranged on the end walls of the casing at the joint between the upper and lower sections thereof. Either of these shafts may serve as the driving member which is connected with a prime motor and is rotated constantly thereby while the other shaft serves as the driven member and may be rotated at different speeds from the driving shaft by means of my improved variable speed gearing which is interposed between these shafts. For convenience of description, however, the shaft 4 at the left hand side of Figs. 1, 2, 3, 4 and 5 will be regarded as the driving shaft and the shaft 5 at the right hand side of these figures as the driven shaft in the following description:

7, 8 represent two hollow tapering or conical drums, pulleys or wheels which are mounted axially respectively on the driving and driven shafts and transversely in line but reversed relatively to each other so that the small end of one cone drum is arranged opposite the large end of the other cone drum, as shown in Figs. 1 and 3. Each of these cone drums comprises a conical or tapering body 9 which is provided with a plurality of longitudinal slots 10, preferably four in number, a hub 11 mounted on one of the drum shafts and provided with the head 12 which is preferably formed integrally with the small end of the body of the drum, and a hub 13 mounted on the same shaft and provided with a head 14 which is detachably connected with the large end of the respective drum body by means of screws 15, as shown in Fig. 3 or by any other suitable means. Each of these drums is compelled to turn with its

shaft but is free to slide lengthwise thereon this being preferably effected by means of a feather 16 on the shaft engaging with a longitudinal feather-way or groove 17 in the bore of the hub at the small end of the drum.

The two drums are caused to move in unison lengthwise of their shafts this being preferably effected by means of a yoke having two longitudinal side bars 18 arranged adjacent to the outer sides of the drums and two cross bars 19 connecting opposite ends of the side bars and each provided with straps 20 which embrace reduced cylindrical portions 21 of the hubs of the drums, whereby shoulders are formed on these hubs which compel the drums and the yoke to move together lengthwise of the shafts but permit the drums to turn with the shafts independently of the yoke.

Various means may be provided for shifting the yoke and the drums lengthwise on the shaft, the means for this purpose shown in the drawings being suitable and consisting of an adjusting rock shaft 22 arranged perpendicular to the driving and driven shafts and journaled in a bearing 23 in the upper section of the frame or casing, a shifting arm 24 secured to the lower end of the adjusting shaft and provided at its free end with a depending pin 25 engaging with a horizontal transverse slot or groove 26 in one of the cross bars of the yoke, and a hand lever 27 secured to the upper end of the adjusting shaft and provided with a hand operated catch 28 which is adapted to engage with one or the other of a segmental row of notches 29 formed in a segment 30 arranged on the top of the casing for the purpose of holding the yoke and the drums in position. The notches 29 may be suitably marked so as to indicate the relative speed at which the driving and driven shafts are rotated when the hand lever 27 is shifted so that the catch 28 engages with a particular notch, thereby permitting of readily adjusting the speed changing gearing for obtaining a predetermined speed.

31, 32 represent two flexible power bands or belts which are mounted respectively on the driving and driven drums and each of which is preferably constructed of a plurality of pivotally connected links which are provided on their outer sides with gear teeth 33. Each of these gear bands is adapted to be engaged circumferentially with different parts of the periphery of one of the conical drums, a longer portion of this band being wrapped around the drum when mounted on the large end thereof while a shorter portion of the same is wrapped around the drum when engaging with the smaller end thereof, thereby producing in effect a flexible gear wheel which is capable of expansion and contraction for varying the diameter of this

gear wheel. Various means may be provided for mounting the gear band on its drum so as to permit of this expansion and contraction and to take up the slack when the operative length of the same is reduced and to pay out the slack when the operative length of the same is increased. The means for this purpose shown in the drawings are suitable and constructed as follows:

34 represents a carriage which is slidable lengthwise in one of the longitudinal slots of the drum and confined against radial displacement therein by engaging the edges or walls on opposite sides of the respective slot with longitudinal grooves in opposite longitudinal sides of this carriage, as shown in Figs. 2, 4 and 7. This carriage is preferably made U-shaped and upon its arms is mounted an antifriction roller 35 which has its axis arranged lengthwise of the drum and its outer side flush with the periphery of the drum. One end of the gear band is connected with that side of the carriage opposite to the antifriction roller thereof and passes thence circumferentially around the drum, thence inwardly around the antifriction roller and through the space within the respective carriage and the adjacent drum slot 10 to the inner side of the drum. That end of the gear band within the drum is connected, preferably by means of a longitudinal pivot pin 36 with annular flanges 37 arranged at opposite ends of a take-up spool the body or hub 38 of which is journaled loosely upon the adjacent part of the shaft of the companion drum. Upon moving the drum and gear band relatively to each other lengthwise of the axis of the drum so that the gear band engages with the smaller end of the drum the spool 37, 38 is turned on the shaft so that the slack at the inner end of the gear band will be wound upon the body or hub of the spool and thereby compensate for the reduction in the length of the band necessary to encircle the periphery of the drum, while upon moving the drum and gear band relatively to each other lengthwise of the axis of the drum so that the gear band engages with the larger end of the latter then the spool is turned in the opposite direction for unwinding the slack at the inner end of the gear band from the spool and paying the same out for supplying the increased length of gear band necessary to encircle the larger diameter of the drum. In order to enable this spool to automatically take-up the slack in the gear band or pay the same out as the drum and gear band are shifted axially one relatively to the other and still keep this gear band taut the movement of the spool is controlled by a controlling device which, in the construction shown in Figs. 1-4, comprises a volute spring 39 encircling the companion shaft at one end of the spool and secured at one end to a collar

40 fixed on the shaft while its opposite end is secured by a pin 41 to the adjacent flange of the spool.

As the drum and gear band are moved axially relatively to each other so that the gear band moves toward the smaller end of the drum and its effective length is shortened the slack at the inner end thereof will be taken up by the spring 39 which yieldingly turns the spool at this time in the proper direction for winding the inner end of the gear band on this spool. But when the gear band is moved relatively to the drum so as to engage with the larger diameter thereof and a greater length of the same is required to encircle the same then the slack of gear band at the inner end thereof is unwound from the spool, during which time the spool is turned backwardly by the pull of the gear band and the spring 39 is wound up or strained. It will thus be seen that by this means the spring 39 permits of automatically taking up or paying out the gear band as required when the latter engages with different parts of the drum and that in all positions of the gear band on the drum the same will be held perfectly taut and caused to engage tightly with the outer side of the drum.

When shifting the drum and gear band so as to engage the latter with the smaller end of the drum the band slides readily from the larger to the smaller end of the drum, this movement being facilitated by the natural tendency of the gear band to slip downwardly on the inclined surface of the drum, aided, if necessary, by lubrication. The movement of the gear band from the smaller to the larger part of the drum is, however, not effected as readily and means are therefore provided for facilitating the movement of the gear band from the smaller to the larger part of the drum. The means for this purpose preferably comprise a spider having a hub 42 which is secured to the shaft of the respective drum and arms 43 radiating from this hub and projecting outwardly through the slots 10 thereof adjacent to that edge of the gear band which faces the small end of the drum. Upon shifting the drum for the purpose of carrying the gear band from the small end toward the large end thereof this band is held in position by engaging the retaining arms of the spider, thereby causing the gear band to expand and gradually increase its diameter in the same measure as the inner side of the gear band is engaged by the gradually increasing diameter of the drum. The hub of the retaining spider is preferably secured to the respective main shaft adjacent to that end of the spool which faces the small end of the drum, so that the spool is confined against longitudinal movement on the shaft between the spider and

the spring collar 40 but is free to turn thereon.

Inasmuch as both drums are moved simultaneously lengthwise of their shafts and held abreast of each other by means of the yoke it follows that when the diameter of the gear band on one drum is increased the diameter of the gear band on the other drum is decreased in the same measure, thereby producing a change in the speed transmitting relation of these gears, the proportion of this relation being different in every position of these gear bands throughout the length of the longitudinal adjusting capacity of the drums relatively to the gear bands. By this means it is possible to obtain a fine adjustment as to the relative speed between the driving and driven shafts which renders this mechanism particularly desirable for use where a wide range of adjustment of speeds is desirable.

If desired the teeth of the gear bands may engage directly with each other but owing to the elastic character of the same it is preferable to interpose separate means for transmitting the movement of the driving gear band to the driven gear band. Such a construction is shown in Figs. 1, 2 and 4 and comprises upper and lower intermediate gear wheels 44, 45 which engage with the upper and lower sides of the gear teeth of both gear bands. Inasmuch as the axis of each of these intermediate gears is shifted as the diameters of the two gear bands increase or decrease relatively to each other it is necessary to provide means to enable these intermediate gear wheels to properly engage the gear bands. The preferred means for this purpose consists of a pair of upper guide arms 46 which are arranged on opposite sides of the upper intermediate gear wheel and pivoted at their upper ends by means of a longitudinal pivot pin 47 to the upper part of the casing while their lower ends are provided with slots 48 forming forks which receive the axles or trunnions 49 on opposite sides of the upper intermediate gear wheel, and similar rock arms 50 are arranged on opposite sides of the lower intermediate gear wheels and pivoted at their lower ends to the lower part of the casing by means of a longitudinal pivot pin 51 while their upper ends are provided with slots 52 to form forks which receive the axles or trunnions 53 on opposite sides of the lower intermediate gear wheel.

The upper intermediate gear wheel is held in engagement with the driving and driven gear bands by gravity but the lower intermediate gear wheel is held yieldingly in its elevated position in engagement with the teeth of the driving and driven gear bands by means of springs 54 arranged on the lower guide arms and bearing at their lower

ends against shoulders on these arms while their upper ends bear against the hub of the lower intermediate gear wheel. It will thus be noted that the upper and lower intermediate gear wheels are free to float into all positions necessary for properly engaging the same with the driving and driven gear bands and thus remain constantly in position to transmit motion from the driving gear band to the driven gear band regardless of the relative diameters of these bands when adjusted for different speeds.

Instead of turning the spool of each drum yieldingly by means of a spring for taking up the slack in the gear band or paying the same out this may be effected positively in both directions. A mechanism suitable for effecting the movement of the spool in the manner last described is shown in Figs. 8 and 9 in which the spool 55 to which the gear band is attached is connected with a sleeve 56 which is mounted on the shaft 57 and provided with a spiral groove or slot 58 which receives a radial pin 59 carried by the hub 60 on the large end of the drum 61. This spiral groove is so constructed that when the drum 61 is shifted lengthwise the pin 59 thereof by operating in the spiral slot will turn the spool 55 in the direction for winding the gear band thereon when the latter is shifted to the smaller end of the drum and a shorter length thereof is required to encircle this part of the drum, while upon shifting the drum so as to engage the gear band with the larger end of the drum the pin 59 will cause the spool to turn in the direction which will permit the gear band to unwind therefrom and supply the additional length of gear band necessary to encircle the greater peripheral portion of the drum.

If desired my improvements may be embodied in a change speed mechanism which contains but one conical drum and a toothless power band which receives an endless belt. An organization of this kind is shown in Figs. 10 and 11 and constructed as follows:

62 is a power band which is mounted on the conical drum 63 in substantially the same manner as the bands 31, 32 are mounted on the drums 7, 8 but which instead of having teeth is provided on its outer side with a longitudinal groove so as to form in effect an expansible and contractible grooved pulley the diameter of which determines the speed which will be transmitted. A belt 64 of rope form passes around this power band and an auxiliary pulley 66 and the belt is engaged by a weight pressed tightening pulley 65 for keeping the same taut regardless of whether the variable pulley formed by the band 62 is large or small.

I claim as my invention:

65 1. In a change speed mechanism, a taper-

ing drum, and a power band mounted on said drum and capable of having more or less of its length arranged circumferentially on the periphery of the drum, and also having more or less of its length arranged within the drum, said band and drum being movable relatively to each other in a direction lengthwise of the axis of the drum. 70

2. In a change speed mechanism, a tapering drum, and a power band mounted on the drum and capable of having more or less of its length arranged circumferentially on the periphery of the drum, and also having more or less of its length arranged within the drum by moving the same axially on the drum. 75 80

3. In a change speed mechanism, a tapering drum, and a power band mounted on the drum and capable of having a greater or lesser portion of its length arranged circumferentially on the periphery of the drum, and also having more or less of its length arranged within the drum. 85

4. In a change speed mechanism, a tapering drum, a power band mounted on the drum and capable of having a greater or lesser portion of its length arranged circumferentially on the periphery of the drum, and means for taking up and paying out said band upon shifting the same from one part of the drum to another. 90 95

5. In a change speed mechanism, a tapering drum, a power band mounted on the drum and capable of having a greater or lesser portion of its length arranged circumferentially on the periphery of the drum, and means for taking up and paying out said band upon shifting the same from one part of the drum to another comprising a spool upon which one end of said band is wound. 100 105

6. In a change speed mechanism, a tapering drum, a power band mounted on the periphery of the drum and capable of having a greater or lesser portion of its length arranged circumferentially on the periphery of the drum, and means for taking up and paying out said band upon shifting the same from one part of the drum to another comprising a spool upon which one end of said band is wound and a spring operating constantly to turn said spool in the direction for winding the band thereon. 110 115

7. A change speed mechanism comprising a shaft, a hollow tapering drum mounted on said shaft and provided with a longitudinal slot, a power band mounted circumferentially on said drum and extending through the slot thereof, and a take-up spool mounted on said shaft and connected with said power band. 120 125

8. A change speed mechanism comprising a shaft, a hollow tapering drum mounted on said shaft and provided with a longitudinal slot, a carriage slidable lengthwise on the 130

drum in the slot thereof, a roller mounted on said carriage, a power band mounted circumferentially on the periphery of said drum and secured at one end to said carriage and passing at its other end over said roller and through said slot into said drum, and a spool mounted on said shaft and secured to that end of said band within the drum.

9. A change speed mechanism comprising a shaft, a hollow tapering drum mounted on said shaft and provided with a longitudinal slot, a carriage slidable lengthwise on the drum in the slot thereof, a roller mounted on said carriage, a power band mounted circumferentially on the periphery of said drum and secured at one end to said carriage and passing at its other end over said roller and through said slot into said drum, a spool mounted on said shaft and secured to that end of said band within the drum and a spring connecting said shaft and spool and operating to turn the latter in the direction for winding the band thereon.

10. A change speed mechanism comprising a shaft, a hollow tapering drum mounted on said shaft and provided with a longitudinal slot, a power band mounted circumferentially on said drum and extending through said slot into the interior of the drum, a take-up device arranged within the drum and connected with said band, and a retaining device engaging with that edge of the band facing the small end of the drum.

11. A change speed mechanism comprising a shaft, a hollow tapering drum mounted on said shaft and provided with a longitudinal slot, a power band mounted circumferentially on said drum and extending through said slot into the interior of the drum, a take-up spool mounted on said shaft and connected with said power band, and a retaining arm mounted on the shaft and extending into said slot and engaging with that side of the band facing the small end of the drum.

12. A change speed mechanism comprising a shaft, a hollow tapering drum movable lengthwise on said shaft but compelled to turn therewith, a yoke movable with said drum but incapable of turning therewith, a power band mounted on said drum and adapted to have more or less of its length arranged circumferentially on the periphery of the drum, and means for shifting said drum axially on said shaft.

13. A change speed mechanism comprising a shaft, a hollow tapering drum movable lengthwise on said shaft but compelled to turn therewith, a yoke movable with said drum but incapable of turning therewith, a power band mounted on said drum and adapted to have more or less of its length arranged circumferentially on the periphery

of the drum, and means for shifting said drum axially on said shaft comprising a rock shaft, an arm arranged on said rock shaft and engaging with said yoke, and a hand lever connected with said rock shaft.

14. A change speed mechanism comprising a shaft, a hollow tapering drum movable lengthwise on said shaft but compelled to turn therewith, a yoke movable with said drum but incapable of turning therewith, a power band mounted on said drum and adapted to have more or less of its length arranged circumferentially on the periphery of the drum, and means for shifting said drum axially on said shaft comprising a rock shaft, an arm arranged on said rock shaft and engaging with said yoke, a hand lever connected with said rock shaft, a locking segment and a catch mounted on said hand lever and engaging with the locking segment.

15. A change speed mechanism comprising two tapering drums arranged reversely to each other, and power bands mounted on said drums and operatively connected with each other and each band adapted to have more or less of its length arranged circumferentially on the periphery of the drum.

16. A change speed mechanism comprising two tapering drums arranged reversely to each other, power bands mounted on said drums and operatively connected with each other and each band adapted to have more or less of its length arranged circumferentially on the periphery of the drum, and an intermediate transmitting wheel engaging with the power bands of both of said drums.

17. A change speed mechanism comprising two tapering drums arranged reversely to each other, power bands mounted on said drums and operatively connected with each other and each band adapted to have more or less of its length arranged circumferentially on the periphery of the drum, an intermediate transmitting wheel engaging with the power bands of both of said drums and means for movably supporting said intermediate wheel.

18. A change speed mechanism comprising two tapering drums arranged reversely to each other, power bands mounted on said drums and operatively connected with each other and each band adapted to have more or less of its length arranged circumferentially on the periphery of the drum, an intermediate transmitting wheel engaging with the power bands of both of said drums, and means for movably supporting said intermediate wheel comprising a rocking guide arm pivoted on a fixed support and provided with a slot which receives the axle of said intermediate wheel.

19. A change speed mechanism comprising two tapering drums arranged reversely to each other, power bands mounted on said

drums and operatively connected with each other and each band adapted to have more or less of its length arranged circumferentially on the periphery of the drum, an
5 upper intermediate transmitting wheel engaging with the upper parts of the power bands of both drums, and a lower intermediate transmitting wheel engaging with
10 the lower parts of the power bands of both drums.

20. A change speed mechanism comprising two tapering drums arranged reversely to each other, power bands mounted on said drums and operatively connected with each
15 other and each band adapted to have more or less of its length arranged circumferen-

tially on the periphery of the drum, an upper intermediate transmitting wheel engaging with the upper parts of the power bands of both drums, a lower intermediate transmitting wheel engaging with the lower parts of the power bands of both drums, an upper rock arm in which the upper wheel is guided, a lower rock arm in which the lower wheel is guided, and a spring for holding the lower
25 wheel yieldingly in its elevated position.

Witness my hand this 24th day of January, 1912.

OLIVER S. SLEEPER.

Witnesses:

THEO. L. POPP,
ANNA HEIGIS.

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