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J. E. HUNTER.
VARIABLE SPEED COUNTER SHAFT MECHANISM.

APPLICATION FILED AUG. 23, 1905.

3 SHEETS—SHEET 1.

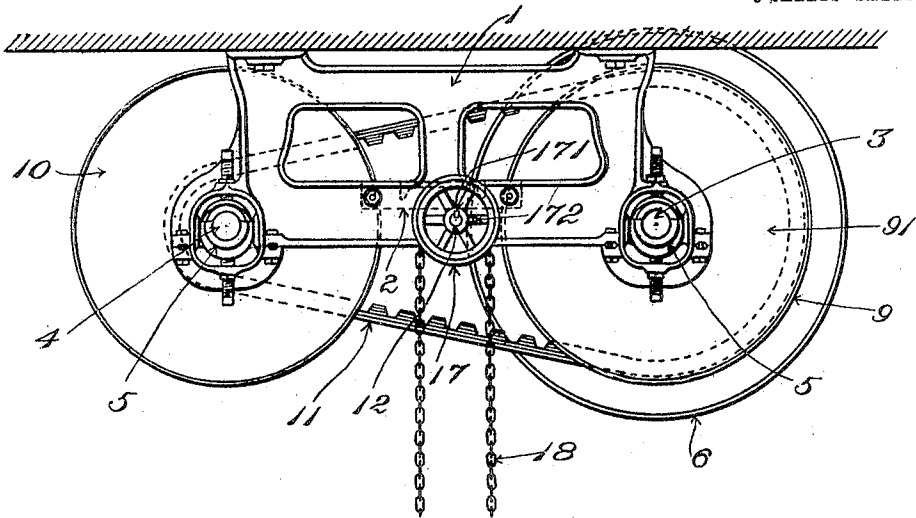


Fig. 1.

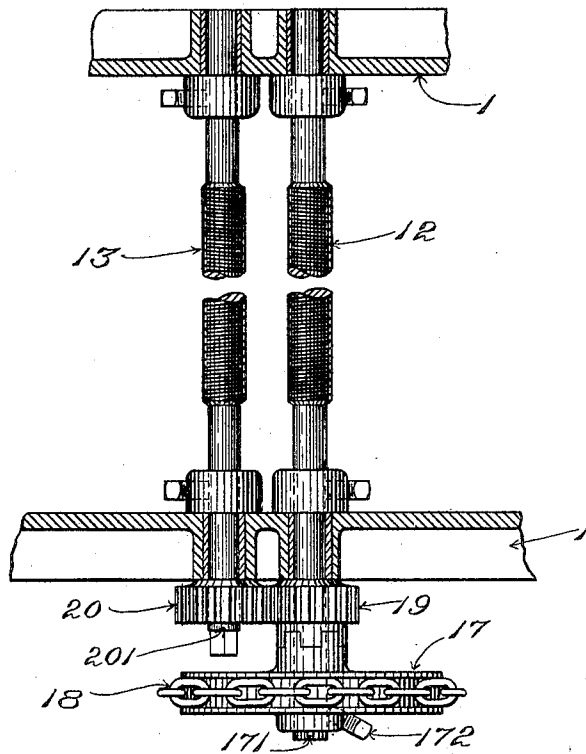
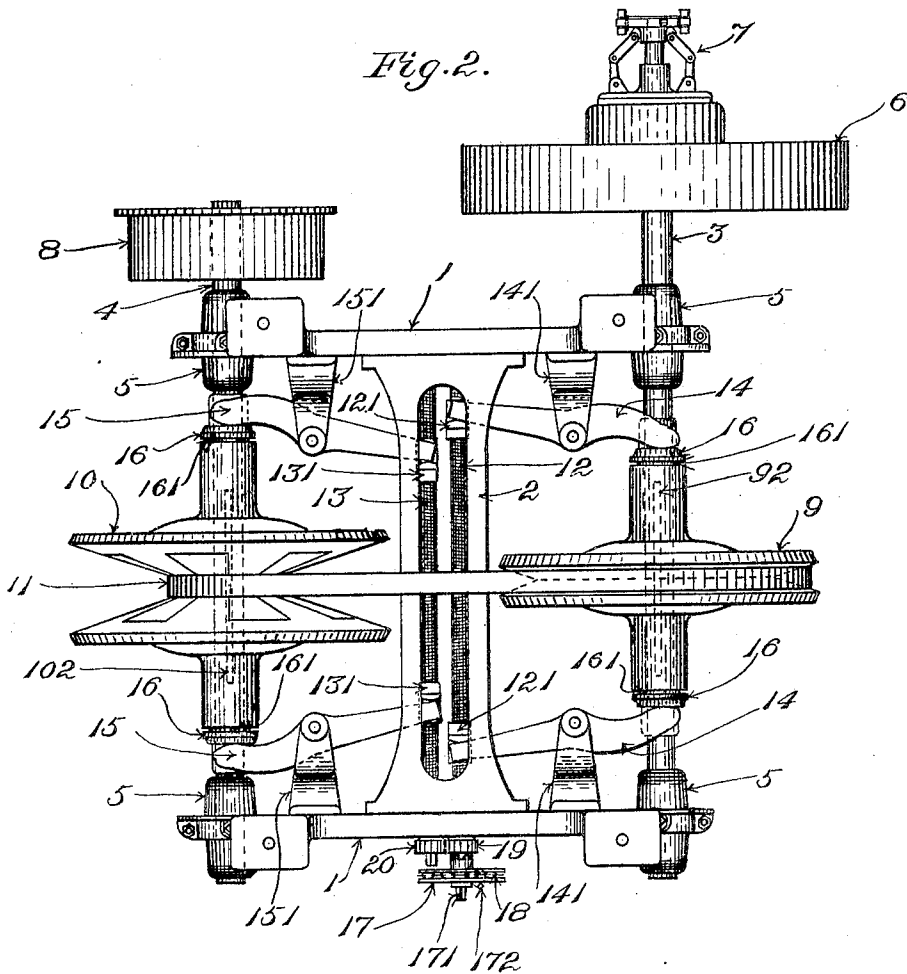


Fig. 3.

Witnesses:
Oscar F. Hill
Edith J. Anderson.

Inventor:
James E. Hunter
By Chas. F. Randall
Attorney.

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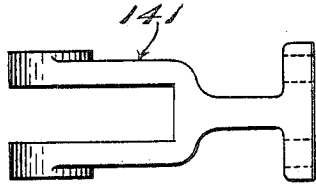


Fig. 6.

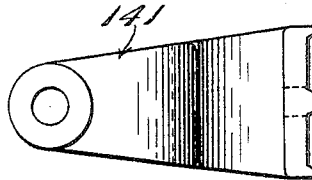


Fig. 7.

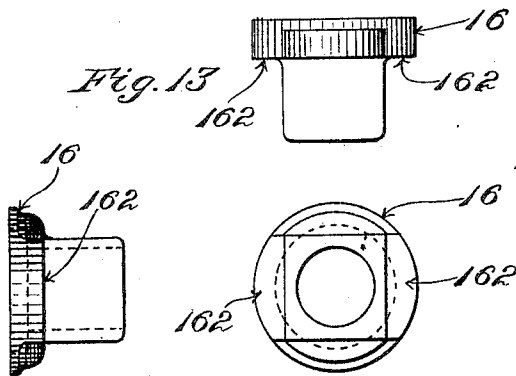


Fig. 11.

Fig. 12.

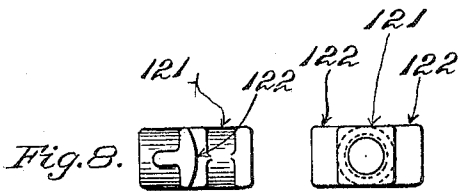


Fig. 8.

Fig. 10.

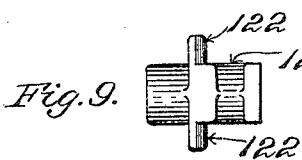


Fig. 9.

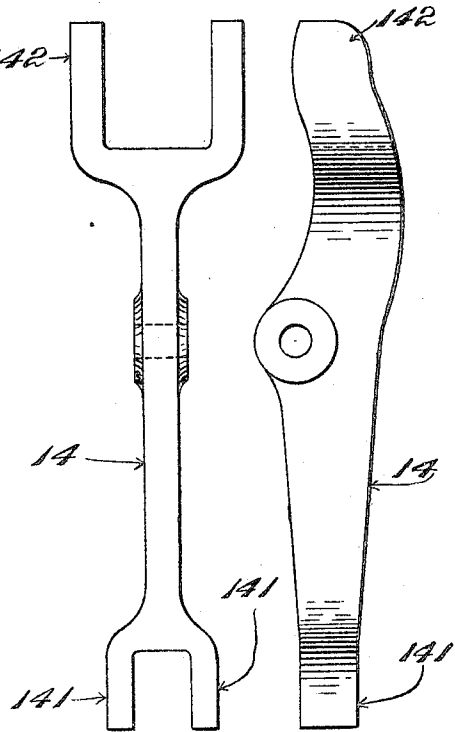


Fig. 4.

Fig. 5.

Witnesses:
Oscar F. Hill
Edith J. Anderson.

Inventor:
James E. Hunter
by Chas. F. Randall
Attorney.

UNITED STATES PATENT OFFICE.

JAMES E. HUNTER, OF NORTH ADAMS, MASSACHUSETTS.

VARIABLE-SPEED COUNTER-SHAFT MECHANISM.

No. 818,450.

Specification of Letters Patent.

Patented April 24, 1906.

Application filed August 23, 1905. Serial No. 275,341.

To all whom it may concern:

Be it known that I, JAMES E. HUNTER, a citizen of the United States, residing at North Adams, in the county of Berkshire, State of Massachusetts, have invented a certain new and useful Improvement in Variable-Speed Counter-Shaft Mechanisms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to counter-shaft mechanism of the type embodying expanding pulleys and means for increasing or decreasing at will the effective diameters of such pulleys, and thereby adjusting the rate of speed that is transmitted.

The objects of the invention are in general to dispense with the use of long operating-levers which heretofore have been employed in mechanisms of the said type and to provide efficient mechanism of novel and improved construction having the parts thereof arranged more compactly and conveniently than in prior mechanisms of such type.

The invention will be explained with the aid of the drawings, in which—

Figure 1 is a side elevation of counter-shaft mechanism containing an embodiment of the invention. Fig. 2 is a plan of the mechanism that is shown in Fig. 1. Fig. 3 is a partly-sectional detail view with portions broken away, showing, on an enlarged scale, the screw-threaded adjusting-rods and the means for actuating the same. Figs. 4 and 5 are edge and plan views, respectively, on an enlarged scale, of one of the transmitting-levers. Figs. 6 and 7 are plan and edge views, respectively, also on an enlarged scale, of one of the lever-stands. Figs. 8, 9, and 10 are views of one of the nuts, also on an enlarged scale. Figs. 11, 12, and 13 are views of one of the thrust-collars, also on an enlarged scale.

In Figs. 1 and 2 the working parts are shown supported by a frame comprising opposite side frames 1 1 and girths 2, the said girth connecting the side frames with each other. At 3 4 are parallel shafts which extend transversely with respect to the said side frames and are mounted in bearings 5 5, that are carried by the side frames. One of these shafts, as 3, has thereon a loose band-pulley, as 6, to receive a driving-band (not shown) from another pulley on a suitable line-shaft. In order to enable the said shaft 3 to be driven, a suitable clutch, as 7, having in connection therewith in practice a suitable

shipper device, (not shown,) is provided in connection with the band-pulley 6. By means of the said clutch driving relations between the pulley and shaft may be established and disestablished when required. The other shaft 4 is provided with a band-pulley, as 8, fixed thereon to receive a driving-band (not shown) for the transmission of power to the machinery which is to be driven. Upon each of the shafts 3 4 is mounted an expanding-pulley, that applied to the shaft 3 being designated 9 and that applied to the shaft 4 being designated 10.

A well-known construction of expanding pulley is shown in the drawings, (see more particularly Fig. 2,) it comprising two cone-shaped members or disks, which respectively are sleeved upon the corresponding shaft with the tapering portion of one of the members or disks facing that of the other thereof, so as to produce a V-shaped opening or groove between the two members or disks. The said shaft is furnished with a longitudinally-extending feather or spline, as 92 in the case of shaft 3 and 102 in the case of shaft 4, which causes the said members or disks to turn in unison with the shaft, while leaving them free to be slid upon the shaft in the direction of the length of the latter. I usually employ expanding pulleys in which the portions thereof which come together are respectively formed with alternating tongues or projections and slots extending in the direction of the length of the shaft, the tongues or projections of one member or disk entering the slots between the tongues of the other member or disk, and vice versa, although this is not a feature of the invention. At 11 is an endless band passing around the two expanding pulleys and working in the grooves thereof, the said band serving for the transmission of motion from the shaft 3 to the shaft 4. The said band is of the well-known construction in use at the present time, embodying one or more continuous thicknesses of leather or other suitable material, forming the body portion thereof, and blocks of leather or the like at the inner side of the said body portion, which are separated from each other by short intervals or spaces to facilitate the bending of the band in passing around the expanding pulleys, the band being made tapered in cross-section to fit the grooves of the said pulleys by having the opposite edges thereof beveled or inclined toward each other. The effective di-

ameter of each of the expanding pulleys is adjusted and varied by causing relative movement of the members or disks of a pulley with respect to each other in the direction of the length of the supporting-shaft for such pulley, so that the band shall ride upon portions of the tapering faces of the said members or disks which are of greater or less diameter, as the case may be. By relative movement of the two members of a pulley toward each other the effective diameter of such pulley is increased, as will be well understood, and by moving them apart from each other the effective diameter is decreased.

The expanding mechanism for the pulleys 9 10 comprises an adjusting device or devices, located intermediately with respect to the two shafts 3 4, and short motion-transmitting members consisting of movable arms or levers, which extend in opposite directions from the adjusting device or devices and are operatively connected with the pulleys to act to expand or reduce, as the case may be, the effective or working diameters of the said pulleys when the motion-transmitting members are moved by the adjusting device or devices.

The expanding mechanism of the construction which is represented in Figs. 1 and 2 is constructed of adjusting-rods 12 13, which extend crosswise of the frame and are supported by the side frames, and transmitting-levers 14 14 and 15 15, which are operatively engaged with the said rods and also with the members or disks of the expanding pulleys. For the support of the transmitting-levers lever-stands 141 141 151 151 are secured to the side frames between the adjusting-rods 12 13 and the shafts 3 4, each transmitting-lever being pivotally mounted in connection with one of the said lever-stands. For the purpose of enabling the levers to be actuated by means of the rods each rod is screw-threaded, it being formed with a right-hand thread along one portion of its length and with a left-hand thread along another portion thereof and is arranged to be rotated in the bearings in which it is supported on the side frames. To the respective screw-threaded portions of each rod nuts are fitted, as at 121 121 in the case of the rod 12 and 131 131 in the case of the rod 13, there being one nut for each of the transmitting-levers. To provide for engagement of a transmitting-lever and the corresponding nut with each other, the inner arm of each transmitting-lever is forked, and the body of the corresponding nut is received between the opposite members 149 149, Figs. 4 and 5, of the fork, the nut having lateral projections 122 122, Figs. 8, 9, and 10, which take against the edges of such members at the side of the lever which is turned toward the middle of the width of the mechanism. For the purpose of enabling the members or disks of the expanding pulleys to

be actuated by means of the transmitting-levers a thrust-collar 16, Figs. 2, 11, 12, and 13, is mounted at the outer end of the sleeve or hub of each of the said members or disks upon the corresponding shaft, washers 161 being introduced between each sleeve or hub and the corresponding thrust-collar to reduce the friction and take the wear, and the outer end 142, Figs. 4 and 5, of the corresponding transmitting-lever is forked and embraces the body of the thrust-collar, the said thrust-collar being formed with radially-projecting shoulders 162 162, Figs. 11, 12, and 13, which are engaged by the edges of the members of the fork which are turned toward the middle of the mechanism. Turning movement of a screw-threaded rod in the direction to cause the nuts which are mounted upon such rod to move away from each other toward the opposite ends of the rod will cause the nuts 121 121 to press outwardly against the inner ends of the transmitting-levers. Thereby the said levers will be turned so as to cause the outer ends of the same to act through the thrust-collars to move the members or disks of the corresponding pulley toward each other, so as to increase or expand the effective diameter of the pulley. Turning movement of the rod in the opposite direction operating to cause the nuts to move toward each other will permit the transmitting-levers to turn under the influence of the pressure that is transmitted to them through the thrust-collars from the members of the pulley, in consequence of the tendency of the band 11 to separate the said members by wedging itself toward the bottom of the band-groove. The adjusting-rods are operated by means of a chain-wheel 17 upon the rod 12, a chain 18, which passes around the said chain-wheel and hangs down in position to be taken hold of by hand conveniently, and spur-pinions 19 20, meshing with each other, the first of which is mounted upon rod 12 and the other upon rod 13. A feather 171, with which the rod 12 is provided, compels the chain-wheel and the said rod to turn together, while permitting the chain-wheel to be shifted along the rod. A clamping-screw 172, Figs. 2 and 3, with which the chain-wheel is provided, enables the chain-wheel to be secured at the place where it is set upon such rod. The pinion 19 is not fast or fixed to the rod 13, but is furnished with projections or teeth which are adapted for engagement with corresponding projections or teeth with which the chain-wheel is furnished. Normally the chain-wheel is fixed by its clamping-screw 172 in a position in which the two sets of projections or teeth are in mutual engagement. Consequently the pinion 19 is caused to turn when the chain-wheel and rod 12 are turned, and through its engagement with the pinion 20, which is fixed to the rod 13 by a key 201, Fig.

3, the latter rod is caused to turn in unison with rod 12. By the turning or rotation of the two rods 12 and 13 in unison the respective pulleys 9 10 are changed simultaneously in their effective or working diameters. The threads upon both of the rods 12 13 are cut alike; but the gearing 19 20 operates to cause the rod 13 to turn oppositely with respect to the rod 12, from which it results that as one pulley is expanded the other is contracted in effective or working diameter, and vice versa. When it is desired to take up slack of the band 11, due to wear, or otherwise regulate the tension of the band from time to time during use, the actuating devices for the adjusting-rods 12 13 may be disconnected temporarily between such rods by loosening the clamping-screw 172 and moving the chain-wheel 17 outward along the rod 12 until the clutching projections or teeth of the said chain-wheel have been withdrawn from engagement with the similar teeth of the pinion 19. This unclutching having been effected, the adjusting devices of the pulley 9 may be operated separately, by means of the chain 18, to independently vary the effective or working diameter of the said pulley, after which by moving the chain-wheel into clutch engagement with the pinion 19 again the mechanism may be restored to its former working condition.

In the foregoing mechanism both members or disks of each expanding pulley are movable upon the shaft of such pulley toward and from each other in the direction of the length of the said shaft. The construction is particularly well adapted for a large-size mechanism suitable for the transmission of considerable power. The construction may be simplified in some cases through the use of expanding pulleys each having one fixed member or disk and one relatively movable member or disk, with an accompanying reduction in the number of transmitting arms or members from four to two, and, if desired, by employing a single adjusting-rod. The levers 14 15 may be replaced by simple movable arms in some instances.

What is claimed as the invention is—

1. In a speed-varying counter-shaft mechanism, the combination with a set of expanding pulleys, and a band connecting the same,

of adjusting means located intermediately with respect to the said pulleys, and separately-movable short arms or levers extending in opposite directions with respect to each other from the said adjusting means to the respective pulleys and operatively connected with the said pulleys to expand and contract the latter.

2. In a speed-varying counter-shaft mechanism, the combination with a set of expanding pulleys, and a band connecting the same, of screw-threaded adjusting means located intermediately with respect to the said pulleys, and separately-movable short pulley-expanding members operated by the said screw-threaded adjusting means and extending in opposite directions with respect to each other from the latter to the respective pulleys.

3. In a speed-varying counter-shaft mechanism, the combination with a set of expanding pulleys, and a band connecting the same, of speed-regulating means located intermediately with respect to the said pulleys, pulley-expanding members extending in opposite directions from the said means to the respective pulleys, and means for adjustment of the pulleys to regulate the tension of the band.

4. In a speed-varying counter-shaft mechanism, the combination with a set of expanding pulleys, and a band connecting the same, of the short arms or levers in operative connection with the said pulleys, adjusting-rods for the said arms or levers, means to adjust the said rods in unison, and means to adjust said rods independently.

5. In a speed-varying counter-shaft mechanism, the combination with a set of expanding pulleys, and a band connecting the same, of the short arms or levers in operative connection with the said pulleys, the adjusting-rods for the said arms or levers, and means to rotate the said rods in unison, provided with a clutch permitting adjustment of the rods independently.

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

JAMES E. HUNTER.

Witnesses:

GEO. C. HADLEY,
W. H. McNEILLY.