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SPEED VARYING POWER DRIVE

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Fig. 1.

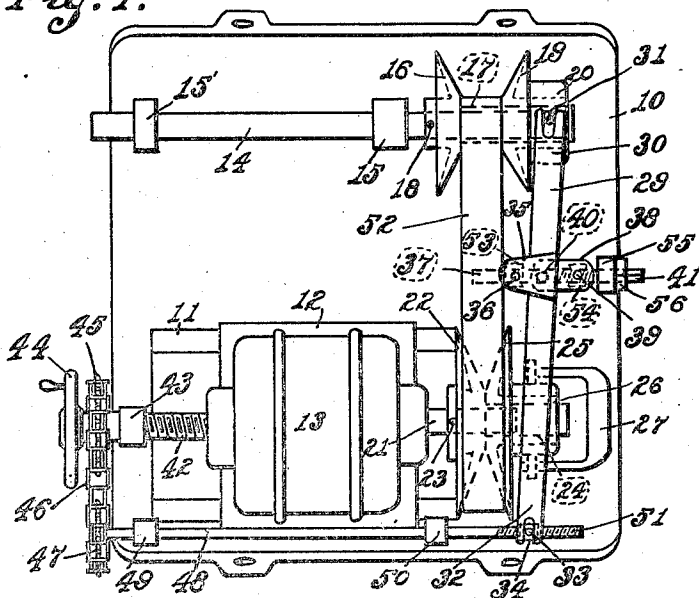
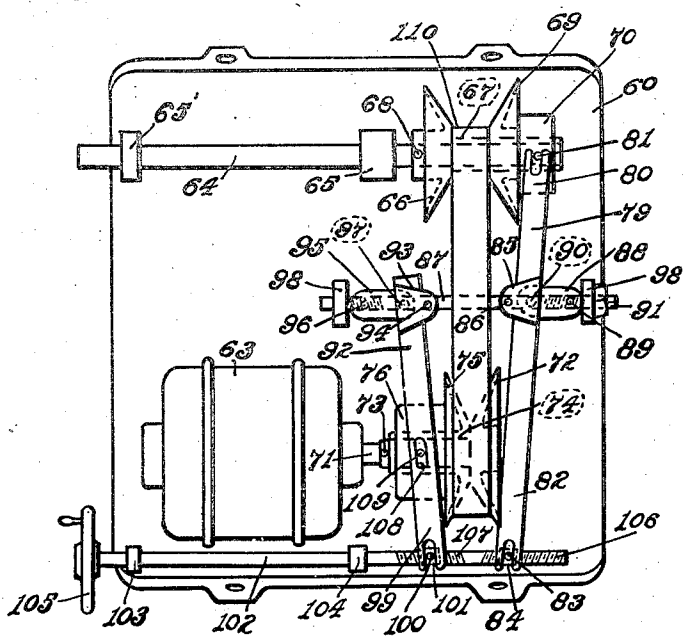


Fig. 2.



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SPEED VARYING POWER DRIVE

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16 Claims. (Cl. 74-230.17)

The present application relates to a speed-varying power drive, and more particularly to a unitary structure comprising a motor, a countershaft, and variable speed means of the incremental type providing a connection whereby the counter shaft is driven by the motor.

The primary object of the invention is to provide a simple and inexpensive structure whereby positive adjustment of the elements of the organization will result in positive, and sensitively responsive, control of speed variation. Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, our invention may be embodied in the forms illustrated in the accompanying drawing, attention being called to the fact, however, that the drawing is illustrative only, and that change may be made in the specific constructions illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a plan view, somewhat diagrammatic, of one embodiment of our invention; and

Fig. 2 is a similar view of another embodiment of the invention.

Referring more particularly to the drawing, it will be seen that, in Fig. 1, we have illustrated a base 10 which is formed to provide a slideway 11 upon which is supported a bed plate 12 carrying a motor 13. A countershaft 14 is journaled in bearings 15 and 15' provided by posts upstanding from said base 10.

Fixed on the shaft 14 is a coned disc 16 having an elongated hub 17 projecting from the coned face thereof; said disc and hub being secured to the shaft 14 by any suitable securing means, as 18. A second coned disc 19 is splined upon the hub 17 of the disc 16 in facing relation to the disc 16; and a thrust bearing 20 is operatively associated with the disc 19 to effect positive axial movement of said disc in either direction.

The motor 13 is provided with the usual spindle 21 upon which is mounted a coned disc 22, said disc being fixed to the spindle 21 by suitable fastening means, as 23. Said disc 22 is provided with an elongated hub 24 projecting from the coned face thereof; and a coned disc 25 is splined upon said hub 24 in facing relation to the disc 22. A thrust bearing 26 is operatively associated with the disc 25 in such manner as to prevent axial relative movement between said disc 25 and said bearing 26. A bracket 27, suitably secured to the base 10, supports the bearing 26 and holds the same against movement in any direction.

A lever 29 has one end 30 bifurcated to em-

brace a pin 31 projecting from the thrust bearing 20; and the opposite end 32 of said lever 29 is similarly bifurcated to embrace a pin 33 projecting from a nut 34.

Said lever is peculiarly mounted upon a fulcrum intermediate its ends, in such a manner as to permit adjustment of the disc 19 relative to the disc 16 by adjustment of the position of the fulcrum. A plate 35 is pivoted, as at 36, upon an element 53 which is slidable upon an unthreaded portion of a screw shaft 37. A link 38 is pivotally mounted at one end, as at 39, upon a nut 54 threadedly mounted on a threaded portion of the shaft 37. The opposite end of the link 38 is pivoted, as at 40, to the plate 35 which, in turn, is rigidly secured to the lever 29. The screw shaft 37 is journaled in bearing 55 provided by a post upstanding from the base 10; and said shaft is held in place by a lock nut 56. The shaft 37 is provided with a non-circular end 41 projecting outwardly beyond said bearing 55 and nut 56, whereby said shaft may be rotated to adjust the position of the fulcrum of the lever 29.

Obviously, it is desirable to duplicate the lever 29 and its mounting upon the opposite side of the bearing 20, in order to avoid the exertion of unbalanced pressure upon said bearing.

A screw shaft 42 is journaled in a bearing 43 provided by a post upstanding from the base 10, and is received in a threaded hub (not shown) on the motor bed plate 12. Said shaft 42 is held against reciprocation; and is provided with a hand wheel 44 beyond the bearing 43 whereby said shaft may be operated. Said shaft 42 further carries a sprocket 45 which, through the medium of a chain 46, is connected to drive a sprocket 47 carried by a further screw shaft 48 journaled in bearings 49 and 50 provided by posts upstanding from the base 10. The nut 34, previously mentioned, is threadedly mounted upon the threaded portion 51 of the shaft 48.

It will be seen that the discs 16 and 19 cooperate to form an expansible V-pulley; and that the discs 22 and 25 likewise cooperate to form an expansible V-pulley. An edge-active belt 52 provides a driving connection between the pulleys formed by the discs 22 and 25 and the pulley formed by the discs 16 and 19. Obviously, when the parts are in the positions illustrated in Fig. 1, the shaft 14 will be driven at a speed greater than the speed of rotation of the spindle 21. If it is desired to decrease the speed of the shaft 14, the hand wheel 44 is rotated in a clockwise direction, as viewed from the left of Fig. 1, whereby the bed plate 12, the motor 13, its spindle

21, and the disc 22 will be moved toward the left, as viewed in Fig. 1. Since the disc 25 is held against axial movement by the thrust bearing 26 and its supporting bracket 27, the result of such movement will be to shift the disc 22 away from the disc 25 to permit the belt 52 to penetrate farther into the V between the discs, thus assuming a position in which the effective diameter of the pulley formed by the discs 22 and 25 is smaller than the effective diameter of said pulley when the parts are in the positions illustrated. Such rotation of the shaft 42 results in corresponding rotation of the shaft 48. Since the thread on the shaft 48 is opposite in pitch to the thread on the shaft 42, such rotation of the shaft 48 will shift the nut 34, and consequently the end 32 of the lever 29, toward the right, as viewed in Fig. 1; whereby the disc 19, through the thrust bearing 20, will be shifted toward the left. Thereby the belt 52 will be forced outwardly between the discs 19 and 16 to assume a position in which the effective diameter of the pulley formed by said discs 16 and 19 will be greater than the effective diameter of said pulley when the parts are in the positions illustrated. Thus, the speed of the shaft 14 will be reduced.

Correspondingly, rotation of the shaft 42 in a counterclockwise direction will result in expansion of the pulley formed by the discs 16 and 19 and contraction of the pulley formed by the discs 22 and 25, to increase the speed of shaft 14.

The parts are so proportioned that operation of the hand wheel 44 in either direction results in movement of the discs 22 and 19 in the same direction but to a slightly different degree, whereby the tension of the belt 52 is maintained substantially constant in all positions of adjustment of the parts of the transmission.

If it is desired to tighten the belt 52, the screw shaft 37 is rotated in a clockwise direction, as viewed from the right of Fig. 1, to shift the fulcrum for the lever 29 toward the left, whereby the disc 19 will be moved toward the disc 16. Similarly, counterclockwise rotation of said shaft 37 will loosen the belt by shifting the disc 19 away from the disc 16. Obviously, operation of the screw shaft 37 will not affect the discs 22, 25 or 16.

The structure of Fig. 2 is quite similar to the structure of Fig. 1, except that the motor is stationarily mounted, and adjustment of both pulleys is effected through the medium of levers. In Fig. 2, the motor 63 is shown mounted stationarily on the base 60, and a shaft 64 is journaled in bearings 65 and 65' provided by posts upstanding from said base. A coned disc 66 having an elongated hub 67 projecting from the coned face thereof is fixed to the shaft 64 by suitable fastening means 68. A coned disc 69 is splined upon the hub 67 in facing relation to the disc 66; and a thrust bearing 70 is operatively associated with said disc 69 to shift the same positively in either direction. Upon the motor spindle 71 is mounted a coned disc 72 having an elongated hub 74 which is fixed to the spindle 71 by suitable fastening means 73. A coned disc 75 is slidably mounted upon the hub 74 in facing relation to the disc 72, and a thrust bearing 76 is operatively associated with said disc 75 to shift the same positively in either direction.

A lever 79 is bifurcated at one end 80 to embrace a pin 81 projecting from the bearing 70; and the opposite end 82 of said lever is likewise bifurcated to embrace a pin 83 projecting from a nut 84. Said lever 79 is similarly mounted upon

a shiftable fulcrum, through the medium of a plate 85 secured to said lever 79 and pivoted at 86 upon a member (not shown) slidably mounted on an unthreaded portion of a screw shaft 87. A link 88 is pivotally mounted as at 89 upon a nut threadedly mounted on the shaft 87; and the opposite end of said link 88 is pivoted, as at 90, to the plate 85. Said screw shaft 87 is journaled in bearings 98 and 98'; and is formed with a projecting end 91 to facilitate rotation of said screw shaft.

A second lever 92 is carried, adjacent one end, by a plate 93 pivoted at 94 upon a member (not shown) slidably mounted upon an unthreaded portion of the screw shaft 87; and a link 95 is pivoted at one end, as at 96, upon a nut (not shown) mounted on a threaded portion of said screw shaft 87; and at its other end said link 95 is pivoted, as at 97, to the plate 93. The two nuts (not shown) which are associated with the respective plates 85 and 93 are mounted upon portions of the screw shaft 87 which are oppositely threaded, as is clearly shown in Fig. 2, so that, as said screw shaft is rotated, said nuts will tend to move in opposite directions.

The opposite end 99 of the lever 92 is bifurcated to embrace a pin 100 projecting from a nut 101. A screw shaft 102 is journaled in bearings 103 and 104 supported on the base 60, and is provided with a hand wheel 105 outside the bearing 103. The nut 84 is threadedly mounted upon a threaded portion 106 of the shaft 102, while the nut 101 is threadedly mounted upon an oppositely threaded portion 107 of the shaft 102; so that, as the screw shaft 102 is rotated, said nuts 84 and 101 will be moved in opposite directions. Intermediate its ends, the lever 92 is formed with a slot 108 in which is received a pin 109 projecting from the bearing 76.

Obviously, it is desirable to provide duplicates of the levers 79 and 92, associated with the opposite sides of the respective bearings 70 and 76.

A belt 110 provides a driving connection between the expansible pulley formed by the discs 72 and 75 and the expansible pulley formed by the discs 66 and 69. Rotation of the hand wheel 105 in a clockwise direction, as viewed from the left of Fig. 2, will move the lower ends of the levers 79 and 92 apart, thereby moving the discs 75 and 69 toward the left, as viewed in Fig. 2, to reduce the speed of the shaft 64. Counterclockwise rotation of said hand wheel will move the discs 75 and 69 toward the right to increase the speed of the shaft 64. If it is desired to tighten the belt 110, the screw shaft 87 is rotated in a clockwise direction, as viewed from the right of Fig. 2, whereby the fulcrums for the respective levers 79 and 92 are moved toward each other, and whereby the disc 69 is moved toward the disc 66 and the disc 75 is moved toward the disc 72. To loosen the belt, of course, the shaft 87 may be rotated in a counterclockwise direction. The parts are so proportioned that, when the screw shaft 102 is rotated, the discs 75 and 69 will always be moved, by operation of the hand wheel 105, in the same direction but to a slightly different degree, as explained in connection with Fig. 1.

It will be noted that, in Fig. 1, the disc which is fixed to the shaft 14 and the disc which is fixed to the spindle 21 face in the same direction; whereas, in Fig. 2, the disc which is fixed to the shaft 64 and the disc which is fixed to the spindle 71 face in opposite directions. In spite of this apparent difference, however, it is true in both the structures illustrated herein that the discs

which move axially, to effect speed variation, face in opposite directions and move always in the same direction, with respect to each other, upon adjustment.

We claim as our invention:

1. In a device of the class described, a pair of parallel shafts, two coned discs mounted on each of said shafts in facing relation, the discs of each pair being relatively axially movable and forming expandible pulleys, a belt providing a driving connection between said pulleys, one disc of one pulley being axially fixed with respect to one disc of the other pulley, and means for positively simultaneously shifting the other discs axially in the same direction, said last-named means including at least one lever mounted upon an adjustable fulcrum, and means for shifting the position of said fulcrum.
2. In a device of the class described, a pair of parallel shafts, two coned discs mounted on each of said shafts in facing relation, the discs of each pair being relatively axially movable and forming expandible pulleys, a belt providing a driving connection between said pulleys, one disc of each pulley being axially fixed to its shaft, and means for shifting at least one of said shafts axially and simultaneously shifting one disc on the other shaft in the same direction with respect to its fellow.
3. In a device of the class described, two parallel shafts, a coned disc fixed to one of said shafts, a coned disc fixed to the other of said shafts, said two coned discs facing in the same direction, a coned disc splined on each of said shafts in facing relation to said respective fixed discs, a belt providing a driving connection between said pairs of discs, and means for shifting one of said shafts axially and simultaneously shifting the splined disc on the other shaft in the same direction.
4. In a device of the class described, an axially shiftable shaft, a coned disc fixed on said shaft, a second coned disc splined on said shaft, means restraining said second disc against axial movement, a second shaft, a third coned disc fixed on said second shaft, a fourth coned disc splined on said second shaft, a belt providing a driving connection between said disc pairs, and means for shifting said first shaft axially and simultaneously shifting said fourth disc axially.
5. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base, a third coned disc fixed on said shaft, a fourth disc splined on said shaft, a belt providing a driving connection between said disc pairs, and means for shifting said motor in the direction of the axis of said spindle and simultaneously shifting said fourth disc axially of its shaft.
6. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base in substantial parallelism to said motor spindle, a third coned disc fixed on said shaft, a fourth disc splined on said shaft, a belt providing a driving

connection between said disc pairs, and means for shifting said motor in the direction of the axis of said spindle and simultaneously shifting said fourth disc axially of its shaft.

7. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base, a third coned disc fixed on said shaft and facing in the same direction as said first disc, a fourth disc splined on said shaft, a belt providing a driving connection between said disc pairs, and means for shifting said motor in the direction of the axis of said spindle and simultaneously shifting said fourth disc axially of its shaft in the same direction.

8. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base, a third coned disc fixed on said shaft and facing in the same direction as said first disc, a fourth coned disc splined on said shaft, a belt providing a driving connection between said disc pairs, a screw shaft mounted on said base, held against axial movement with respect thereto, and operatively associated with said motor, a second screw shaft mounted on said base and held against axial movement with respect thereto, means connecting said screw shafts to rotate together, and means operatively connecting said second screw shaft to said fourth disc whereby rotation of said screw shafts simultaneously shifts said motor and said fourth disc axially in the same direction.

9. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base, a third coned disc fixed on said shaft, a fourth disc splined on said shaft, a belt providing a driving connection between said disc pairs, a screw shaft carried by said base, held against axial movement with respect thereto, and operatively associated with said motor, a second screw shaft carried by said base and held against axial movement with respect thereto, means connecting said screw shafts to rotate together, a nut mounted on said second screw shaft, and held against rotation, a thrust bearing operatively associated with said fourth disc, and a lever fulcrumed on said base and engaging said nut and said thrust bearing.

10. In a device of the class described, a base, a motor having a spindle and mounted on said base for movement in the direction of the axis of its spindle, a coned disc fixed on said spindle, a second coned disc splined on said spindle, means carried by said base for holding said second disc against movement in the direction of the axis of said spindle, a shaft mounted on said base, a third coned disc fixed on said shaft, a fourth disc splined on said shaft, a belt providing a driving connection between said disc pairs, a screw shaft

carried by said base, held against axial movement with respect thereto, and operatively associated with said motor, a second screw shaft carried by said base and held against axial movement with respect thereto, means connecting said screw shafts to rotate together, a nut mounted on said second screw shaft, and held against rotation, a thrust bearing operatively associated with said fourth disc, a fulcrum adjustably mounted on said base, and a lever pivoted on said fulcrum and operatively engaging said nut and said thrust bearing.

11. In a device of the class described, two substantially parallel shafts, a coned disc fixedly mounted on each of said shafts, each having an elongated hub projecting from the coned face thereof, a coned disc slidably mounted on each of said hubs in facing relation to its associated disc, a belt providing a driving connection between said disc pairs, and means for positively effecting relative axial movement of the discs of said respective disc pairs in either direction.

12. In a device of the class described, a first shaft, a second shaft substantially parallel therewith, a coned disc fixedly mounted on said first shaft and having an elongated hub projecting from its coned face, a second coned disc slidably mounted on said hub in facing relation to said first disc, a third coned disc fixedly mounted on said second shaft and having an elongated hub projecting from its coned face, a fourth coned disc slidably mounted on the hub of said third disc in facing relation to said third disc, said first and second discs and said third and fourth discs thus providing two expansible V-pulleys, an edge-active belt providing a driving connection between said pulleys, and means for simultaneously and positively shifting one disc of each pulley with respect to its associated disc in either direction to expand one pulley and to contract the other pulley in substantially equal amounts.

13. In a device of the class described, a first shaft, a second shaft substantially parallel therewith, a coned disc fixedly mounted on said first shaft and having an elongated hub projecting from its coned face, a second coned disc slidably mounted on said hub in facing relation to said first disc, a third coned disc fixedly mounted on said second shaft and having an elongated hub projecting from its coned face, a fourth coned disc slidably mounted on the hub of said third disc in facing relation to said third disc, said first and second discs and said third and fourth discs thus providing two expansible V-pulleys, an edge-active belt providing a driving connection between said pulleys, and means for shifting one of said shafts and its fixed disc while holding its slidable disc against concurrent movement, and simultaneously shifting the slidable disc of the other shaft in the same direction.

14. In a device of the class described, a first shaft, a second shaft substantially parallel therewith, a coned disc fixedly mounted on said first shaft and having an elongated hub projecting from its coned face, a second coned disc slidably mounted on said hub in facing relation to said

first disc, a third coned disc fixedly mounted on said second shaft and having an elongated hub projecting from its coned face, a fourth coned disc slidably mounted on the hub of said third disc in facing relation to said third disc, said first and second discs and said third and fourth discs thus providing two expansible V-pulleys, an edge-active belt providing a driving connection between said pulleys, a lever operatively connected to said second disc, a second lever operatively connected to said fourth disc, and screw means operatively associated with both of said levers, and operable, when rotated, to move said levers simultaneously in opposite directions to shift said second and fourth discs in the same direction.

15. In a device of the class described, a first shaft, a second shaft substantially parallel therewith, a coned disc fixedly mounted on said first shaft and having an elongated hub projecting from its coned face, a second coned disc slidably mounted on said hub in facing relation to said first disc, a third coned disc fixedly mounted on said second shaft and having an elongated hub projecting from its coned face, a fourth coned disc slidably mounted on the hub of said third disc in facing relation to said third disc, said first and second discs and said third and fourth discs thus providing two expansible V-pulleys, an edge-active belt providing a driving connection between said pulleys, a lever pivoted intermediate its ends upon a fulcrum and operatively connected at one end to said second disc, a second lever pivoted adjacent one end upon a fulcrum and operatively connected intermediate its ends to said fourth disc, a screw shaft, and means providing operative connections between said screw shaft and the other end of each of said levers.

16. In a device of the class described, a first shaft, a second shaft substantially parallel therewith, a coned disc fixedly mounted on said first shaft and having an elongated hub projecting from its coned face, a second coned disc slidably mounted on said hub in facing relation to said first disc, a third coned disc fixedly mounted on said second shaft and having an elongated hub projecting from its coned face, a fourth coned disc slidably mounted on the hub of said third disc in facing relation to said third disc, said first and second discs and said third and fourth discs thus providing two expansible V-pulleys, an edge-active belt providing a driving connection between said pulleys, a lever pivoted intermediate its ends upon a fulcrum and operatively connected at one end to said second disc, a second lever pivoted adjacent one end upon a fulcrum and operatively connected intermediate its ends to said fourth disc, a screw shaft, means providing operative connections between said screw shaft and the other end of each of said levers, and means for simultaneously shifting said fulcrums in opposite directions.

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