

No. 834,212.

PATENTED OCT. 23, 1906.

L. A. LOHR.  
SPEED VARYING APPARATUS.  
APPLICATION FILED APR. 22, 1903.

2 SHEETS—SHEET 1.

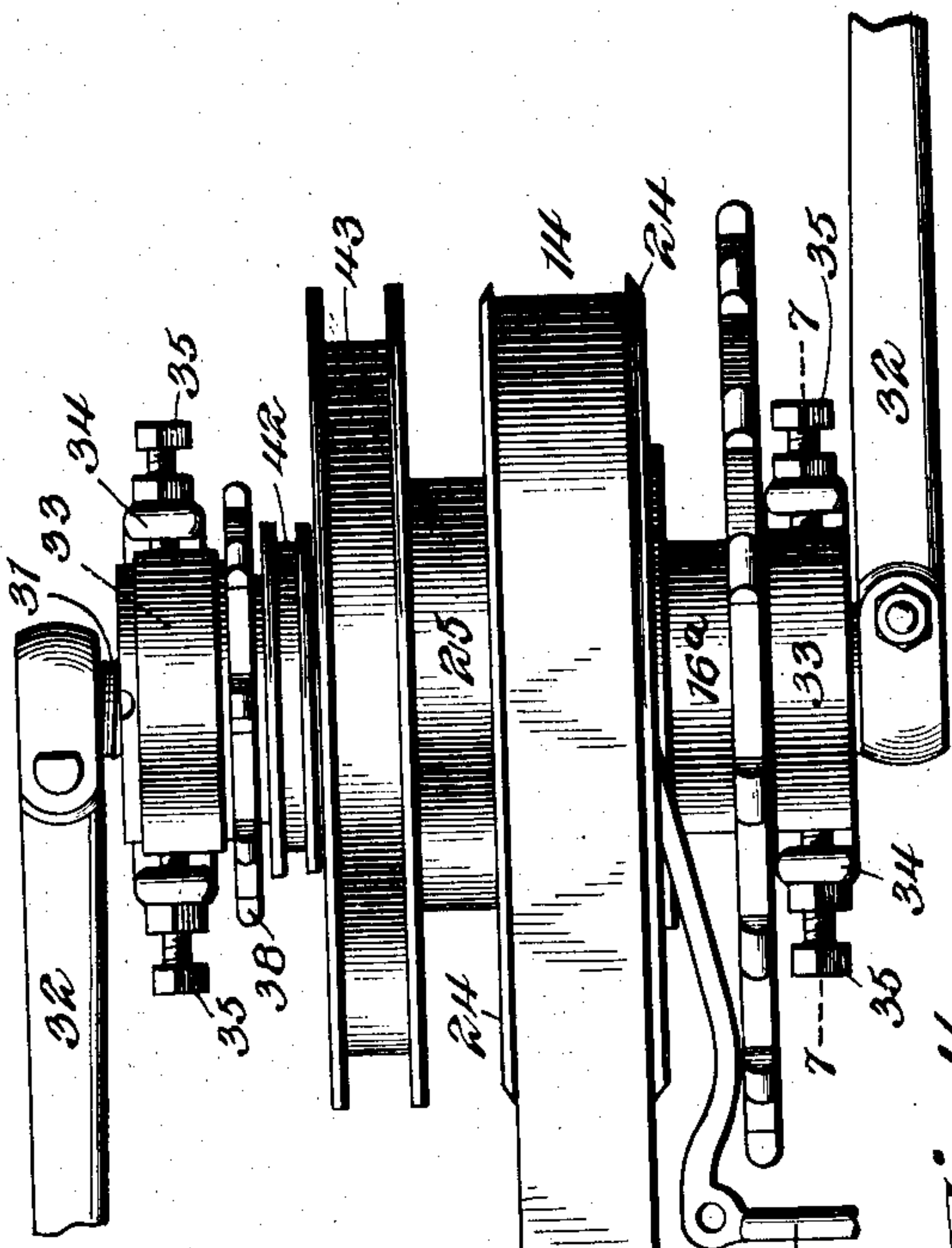


Fig. 1.

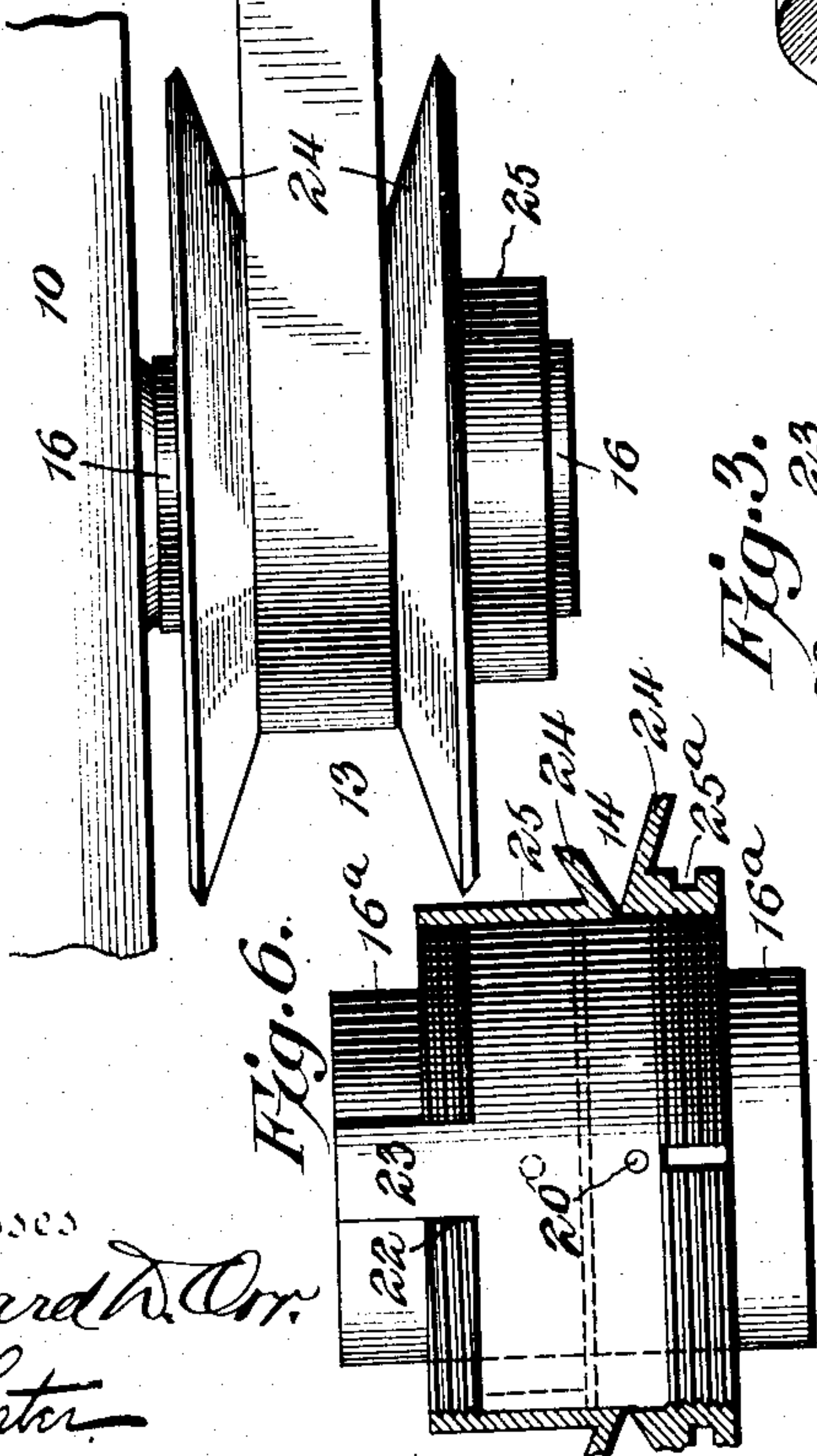


Fig. 2.

Fig. 3.

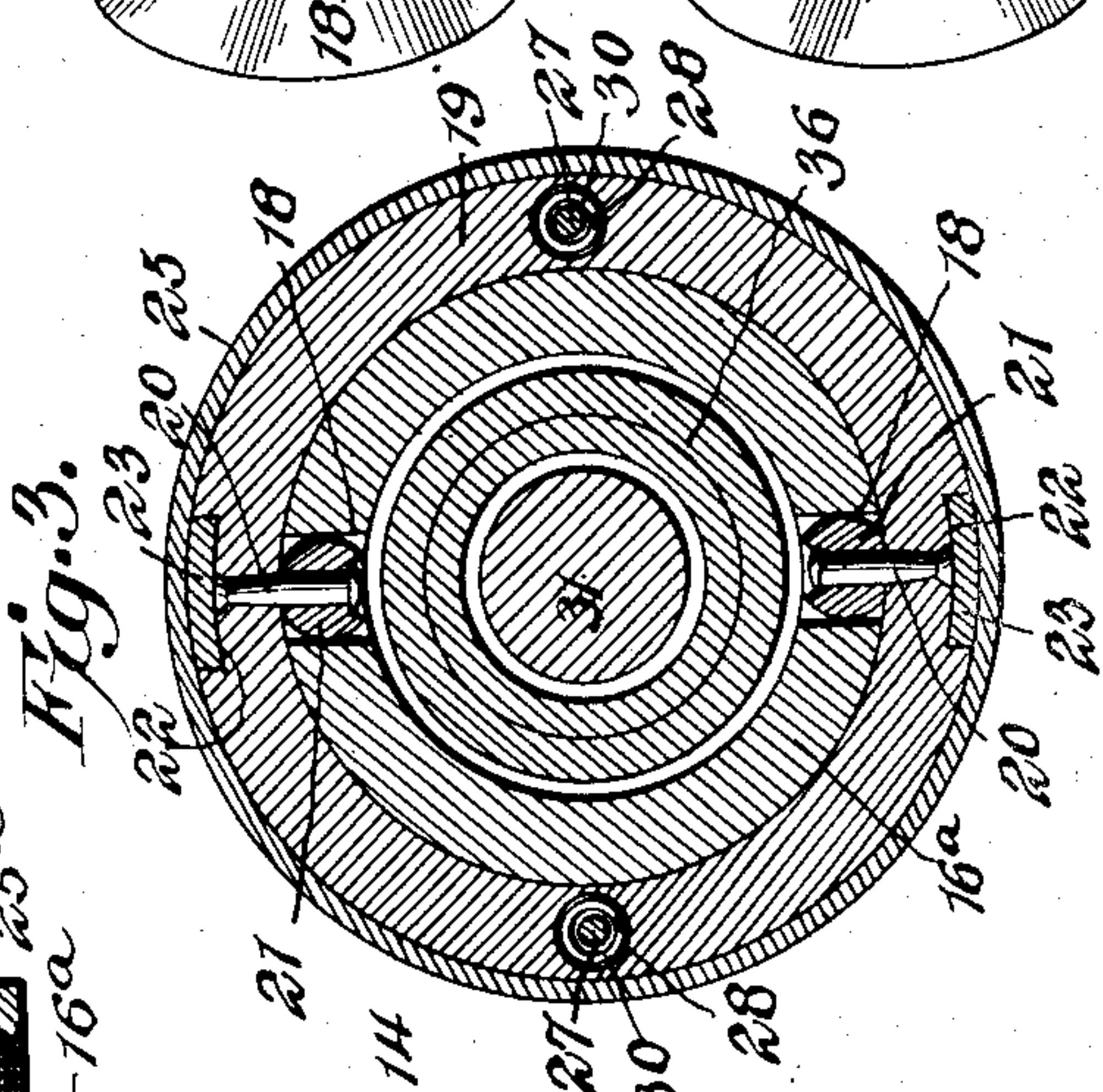


Fig. 4.

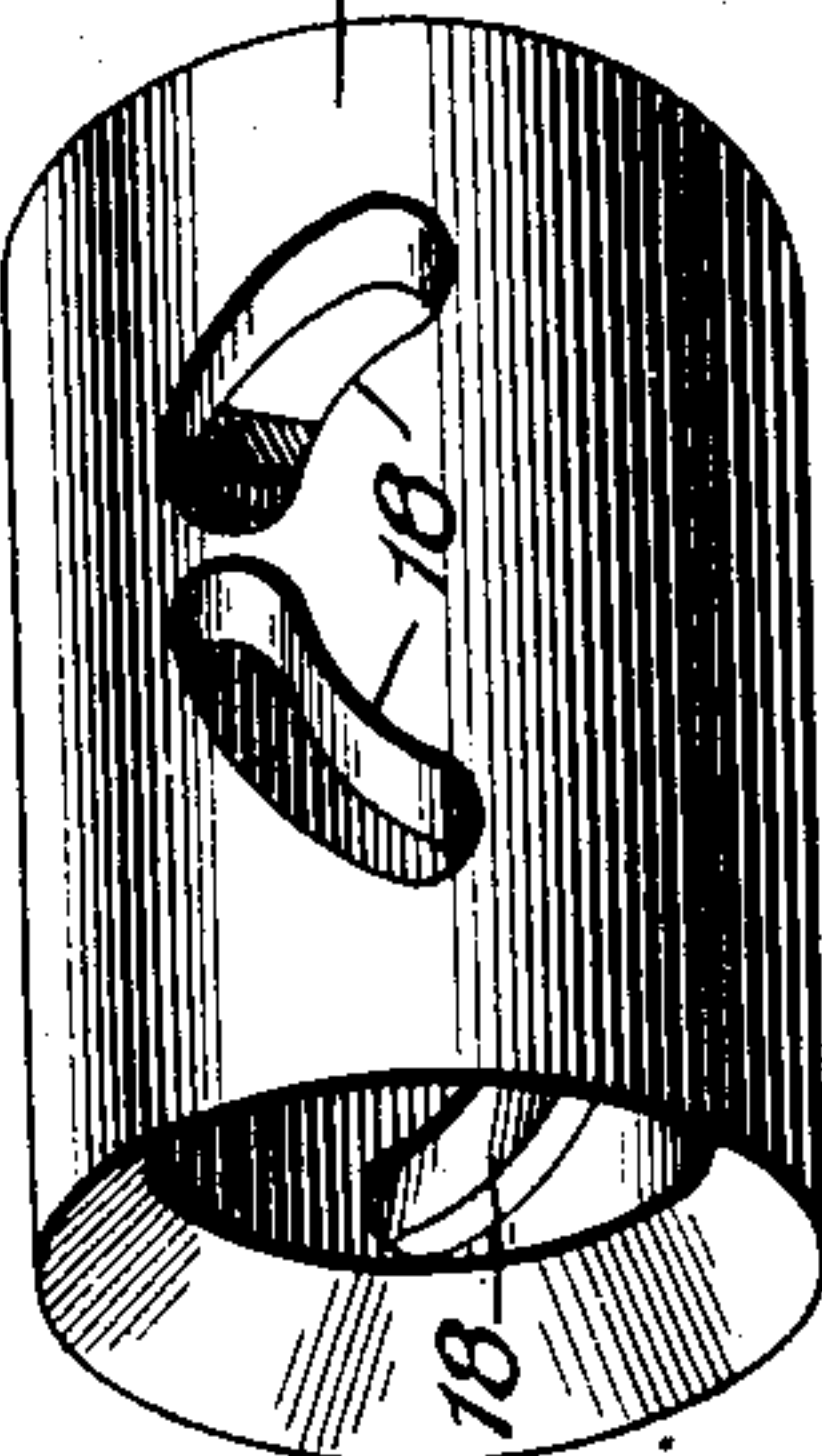


Fig. 5.

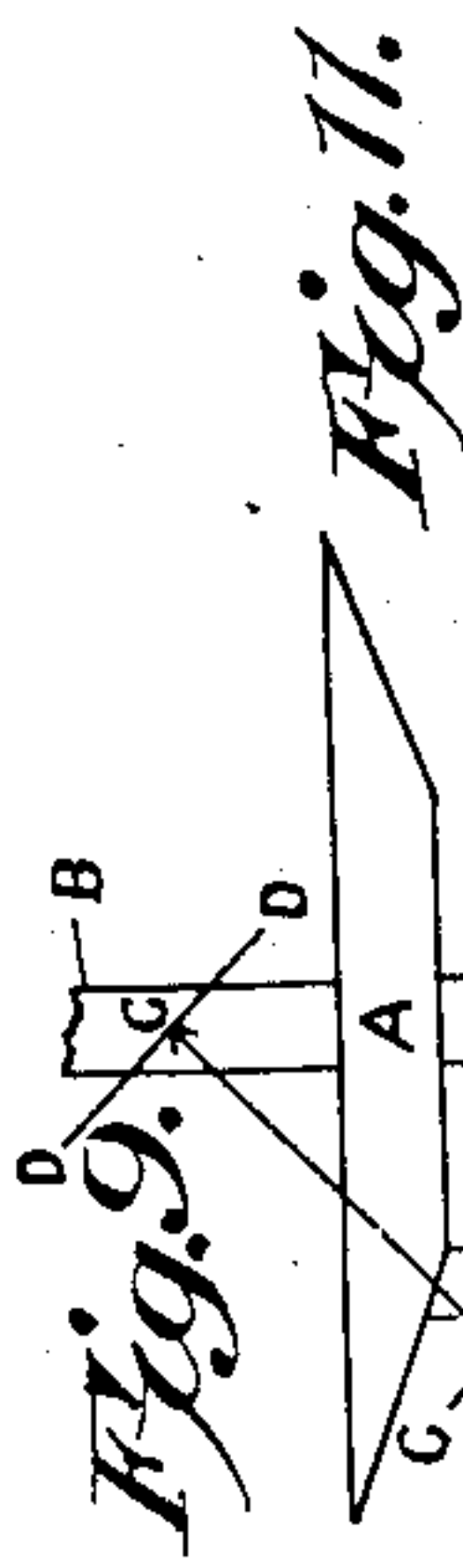
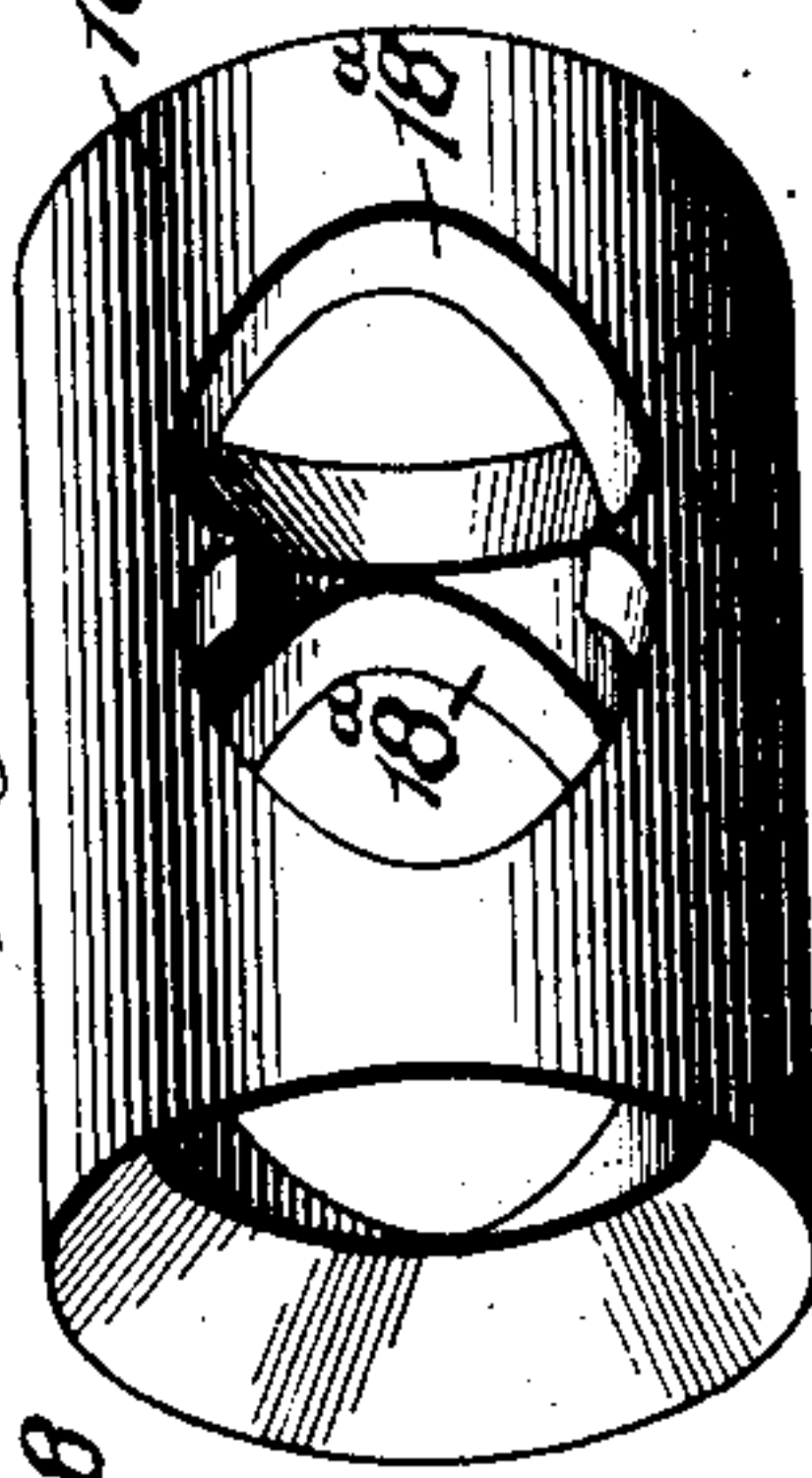


Fig. 7.

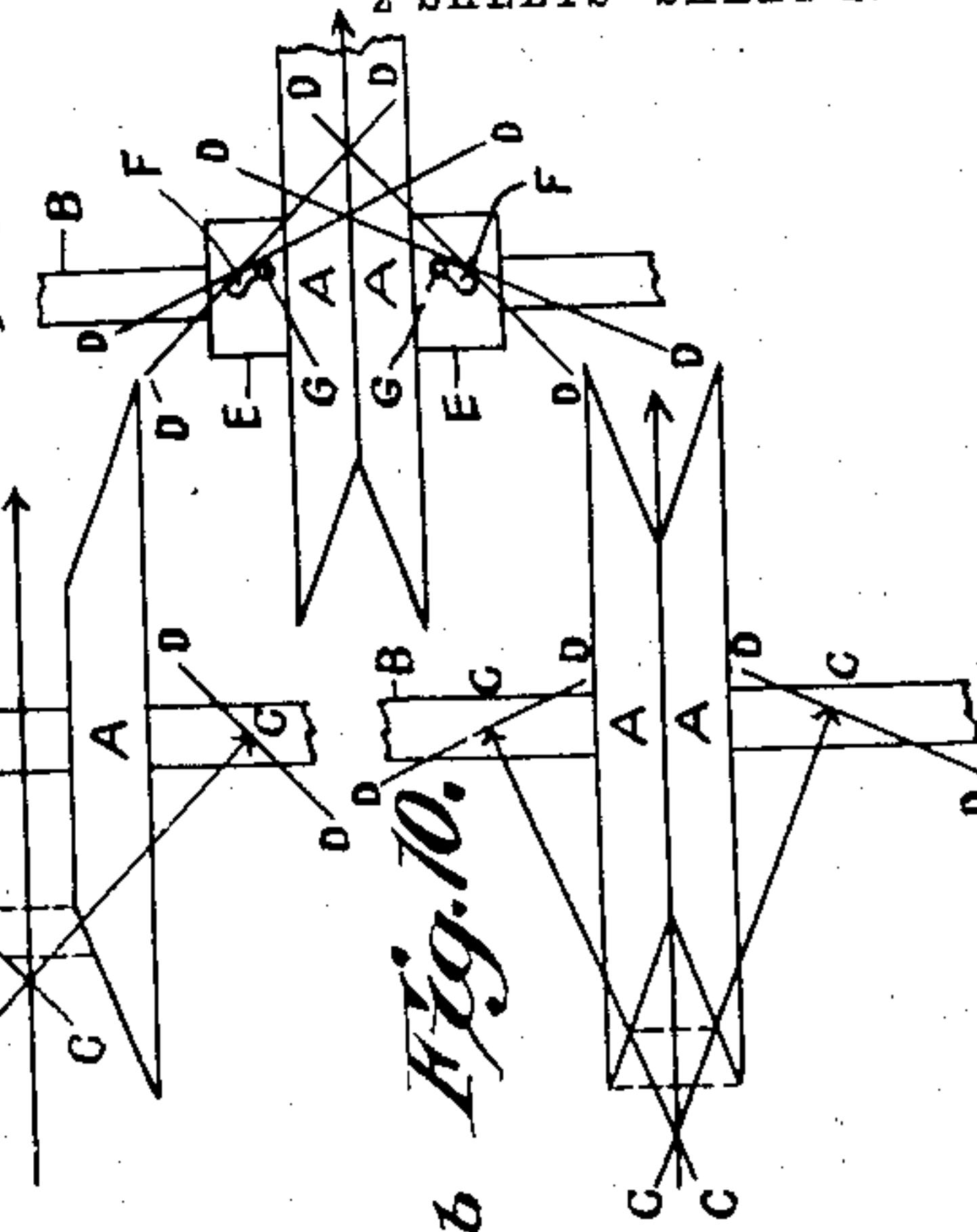


Fig. 8.

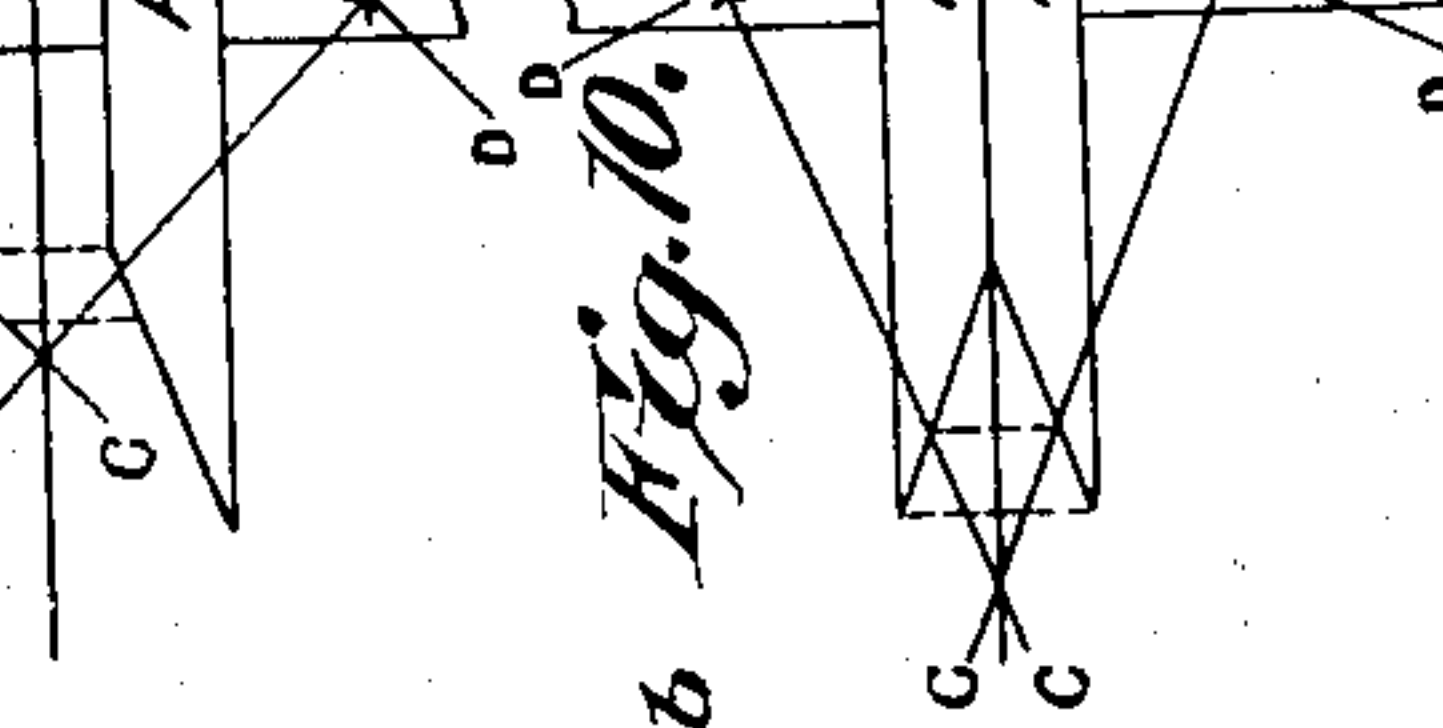


Fig. 9.

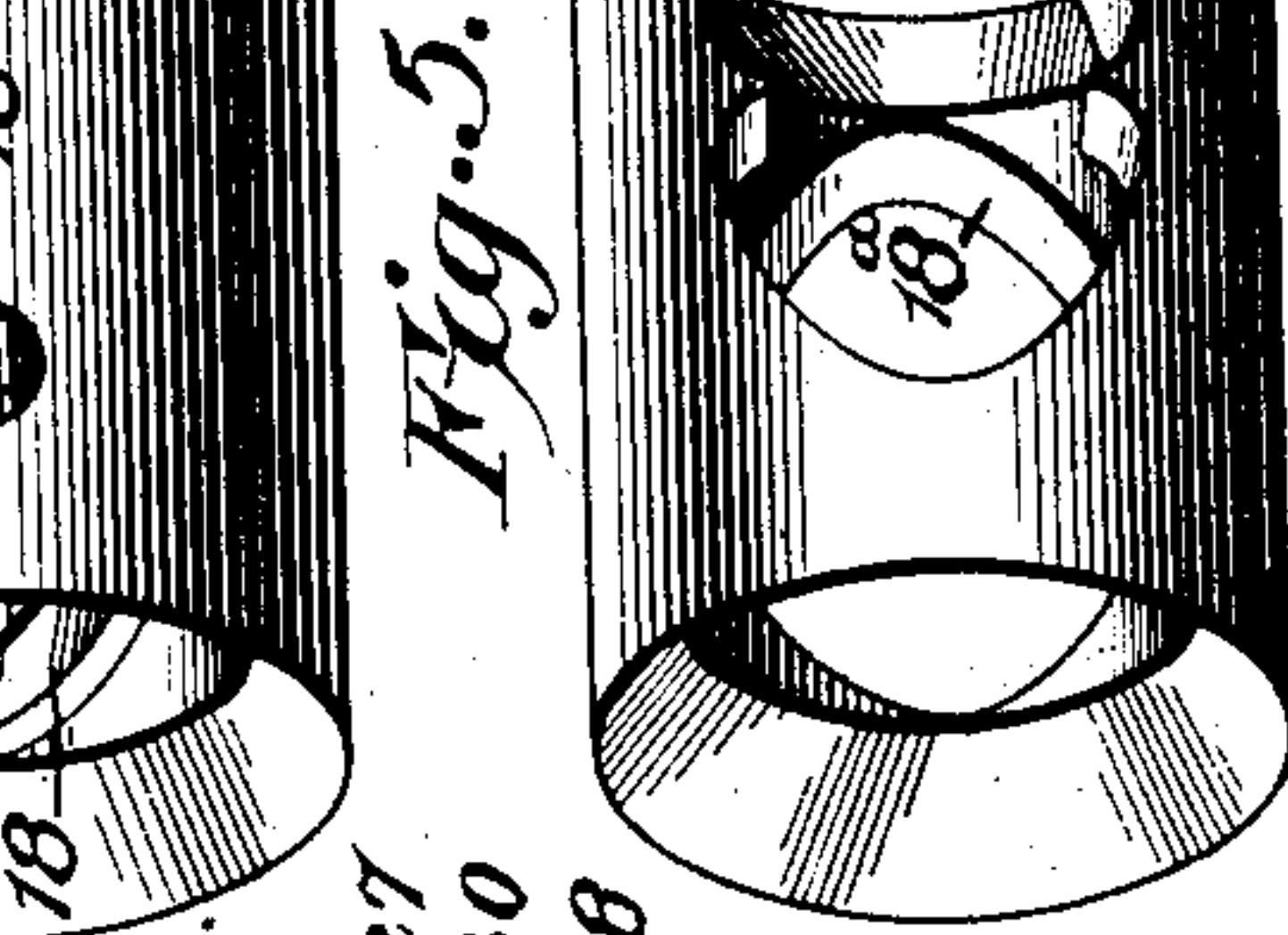


Fig. 10.

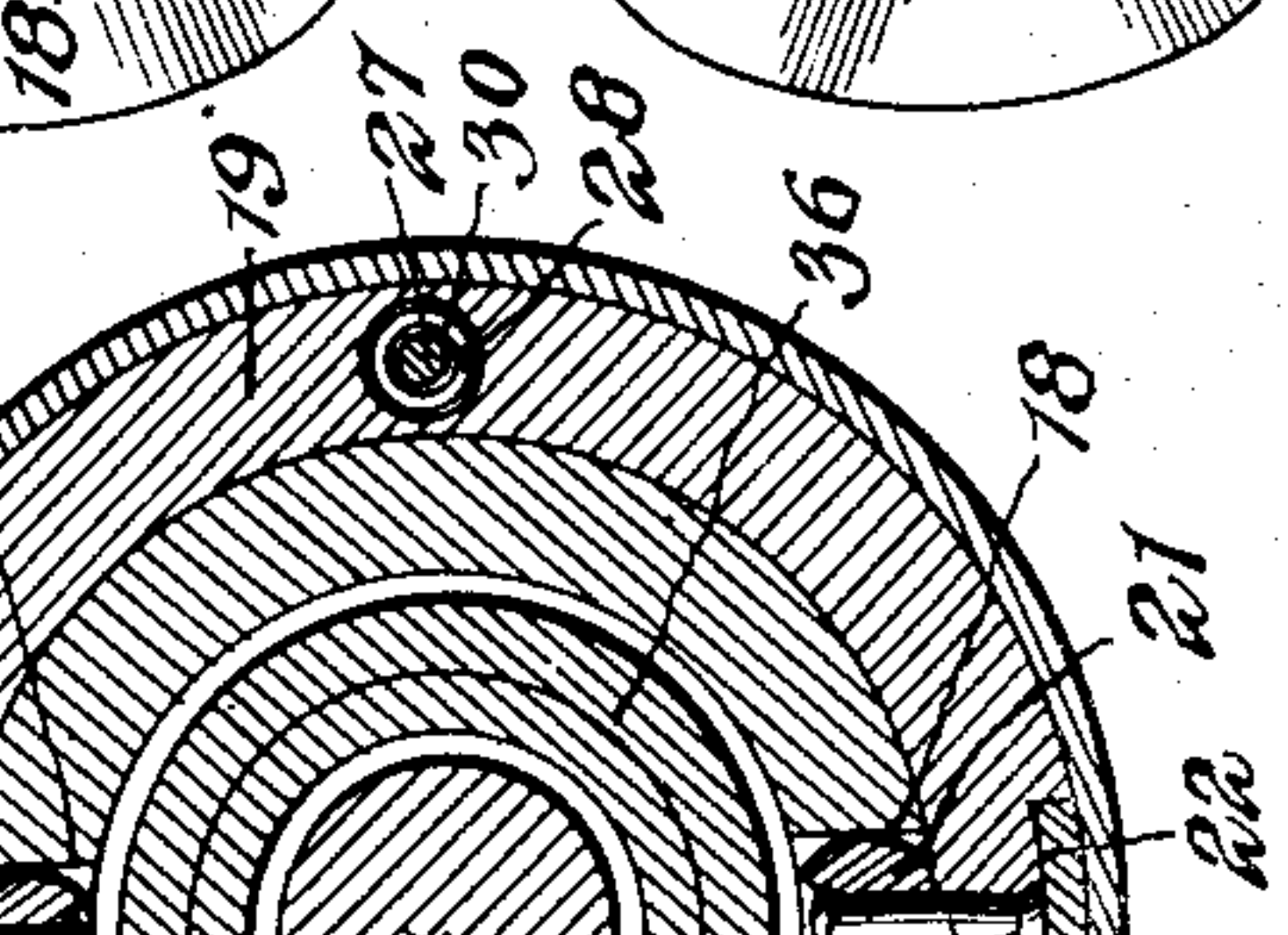
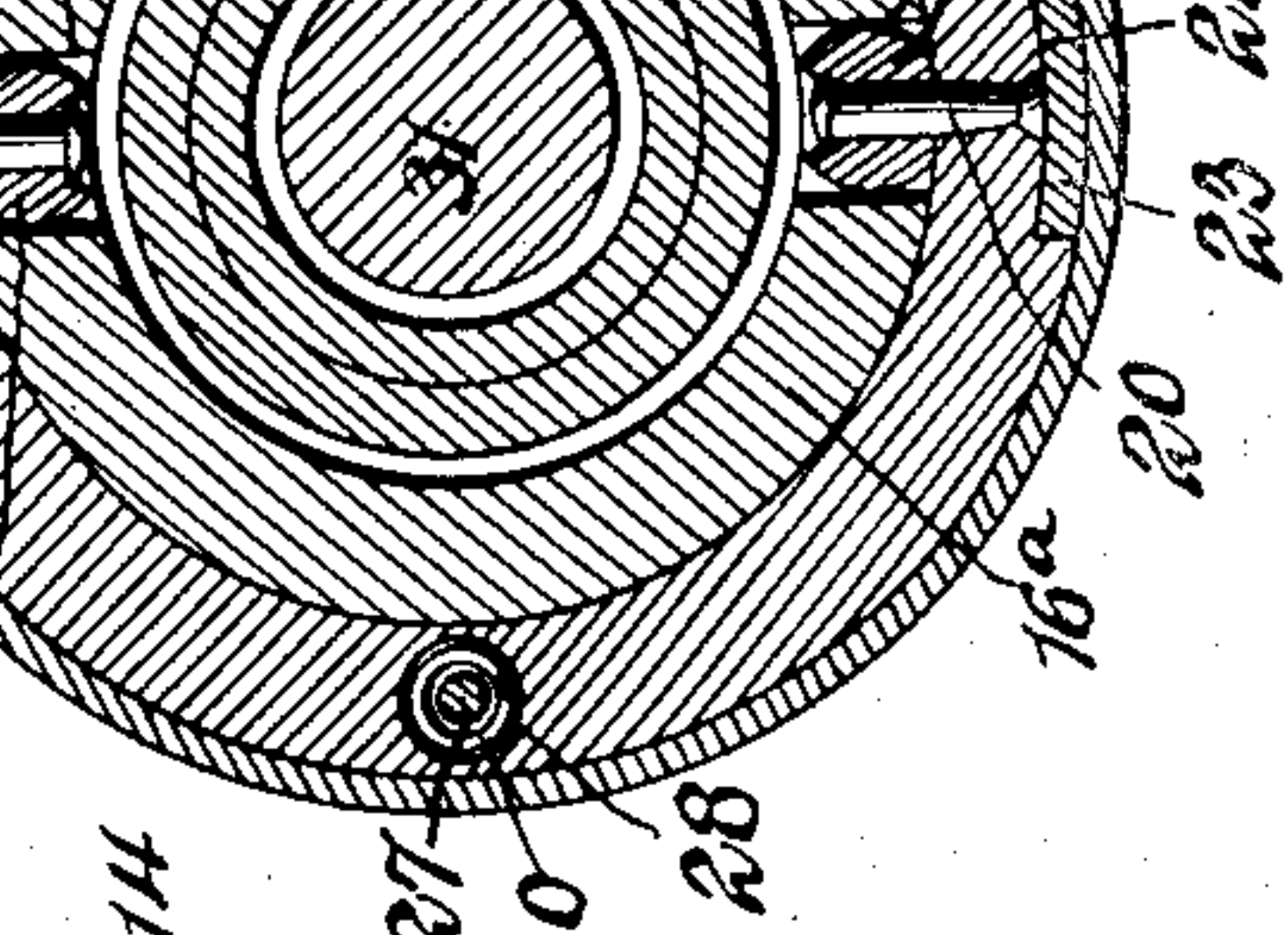


Fig. 11.



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Luther A. Lohr, Inventor,  
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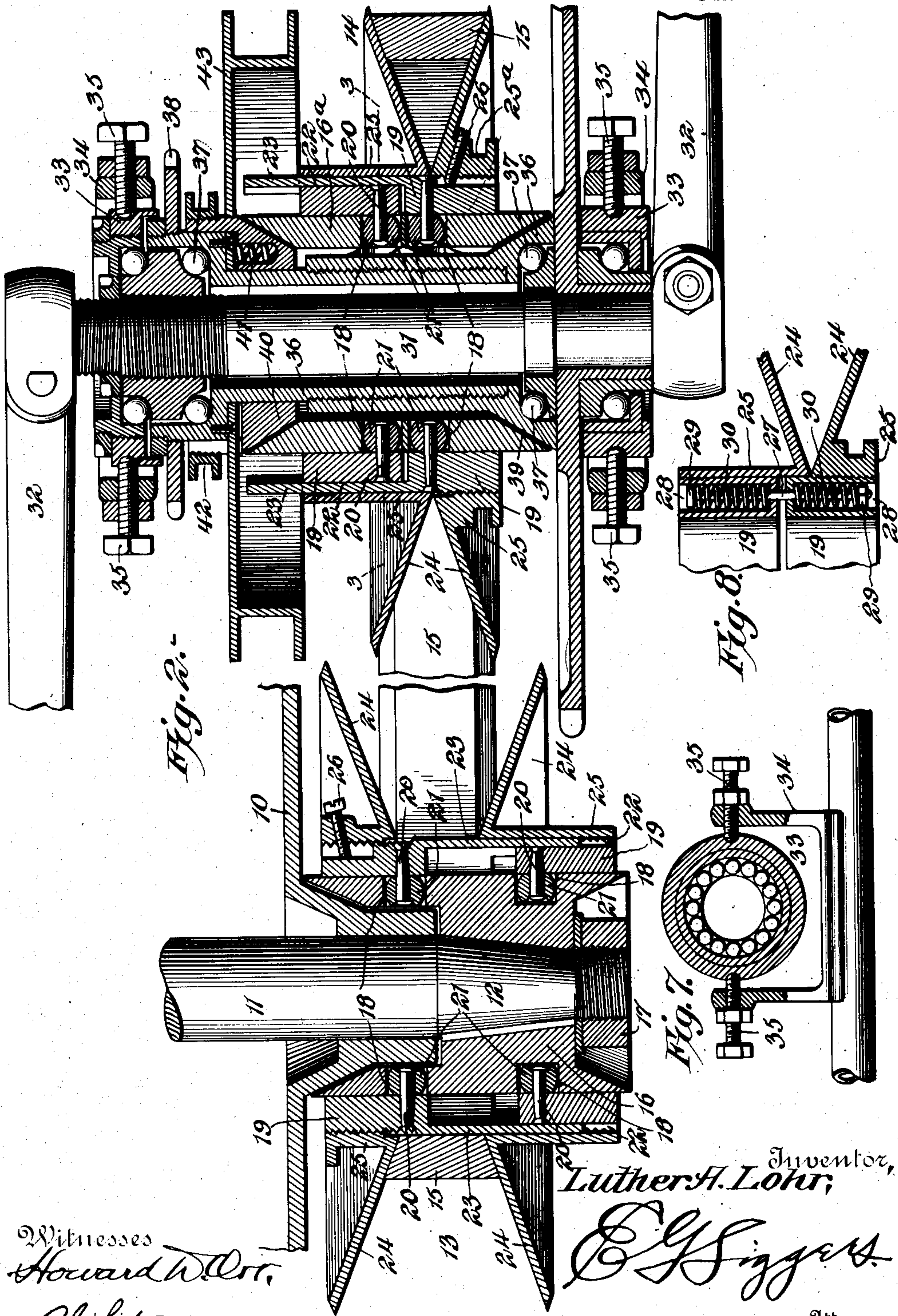
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2 SHEETS—SHEET 2.



Witnesses  
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# UNITED STATES PATENT OFFICE.

LUTHER A. LOHR, OF NEWMARKET, VIRGINIA.

## SPEED-VARYING APPARATUS.

No. 834,212.

Specification of Letters Patent.

Patented Oct. 23, 1906.

Application filed April 22, 1903. Serial No. 153,834.

*To all whom it may concern:*

Be it known that I, LUTHER A. LOHR, a citizen of the United States, residing at Newmarket, in the county of Shenandoah and State of Virginia, have invented a new and useful Speed-Varying Apparatus, of which the following is a specification.

The present invention relates to speed-varying apparatus, and while particularly applicable to motor-vehicles—as, for instance, self-propelled bicycles—it will be apparent to those skilled in the art that it may be employed for various mechanical purposes.

One of the objects of the invention is to provide an expansible pulley wherein there will be no end-thrust due to the “belt pull” against any stationary part, thus obviating the necessity of the usual stationary thrust-bearing and at the same time provide simple means for expanding and contracting the pulley, the arrangement being such that the friction of the parts, due to their relative movements, is reduced to a minimum.

Another object is to provide a structure of the above character in which the elements are thoroughly housed from dust and dirt and present a simple exterior conformation that is exceedingly compact.

One embodiment of the invention is illustrated in the accompanying drawings and is described in the following specification. It will be apparent upon an inspection of the claims that the structure shown and described is open to various changes and modifications.

In the drawings, Figure 1 is a plan view of the improved apparatus. Fig. 2 is a longitudinal sectional view through the same on an enlarged scale. Fig. 3 is a transverse sectional view through the driven pulley on the line 3 3 of Fig. 2. Fig. 4 is a detail perspective view of one form of sleeve employed in the driven pulley. Fig. 5 is a similar view of a modified form of construction. Fig. 6 is a plan view of a portion of the driven pulley, certain parts being broken away to more clearly show the interior construction and arrangement. Fig. 7 is a detail sectional view taken on the line 7 7 of Fig. 1. Fig. 8 is a detail sectional view through two of the collars, showing the spring connection for urging them toward each other. Figs. 9, 10, and 11 are diagrammatic views.

Similar reference characters indicate corre-

sponding parts in all the figures of the drawings. 55

Before proceeding with the description of the structure illustrated the principle of the invention should first be understood, and it is believed that it can be best explained by diagrammatic Figs. 9, 10, and 11. 60

In an expansible pulley having disks provided with inclined faces upon which the belt runs if nothing prohibits the free relative movement of the disks the belt tension will of course separate said disks. If, however, abutments are attached to the shaft or other support on which the disks are placed and said abutments are located across the paths of movement of the disks, it will be evident that their movements upon the shaft will be prohibited and that the shaft will be rotated with the disks. I have discovered, however, that the direction of such paths of movement of the disks upon the shaft varies somewhat, according to the position of the belts with respect to the peripheries of said disk, and that in order to hold the disks against relative movement and in different positions with respect to each other curved abutments are at least preferable. As explanatory of the above in Figs. 9, 10, and 11 an expansible pulley is illustrated having heads A, provided with opposing inclined faces upon which the belt operates. These heads are located upon a shaft or other rotatable part B, and it will be evident that if the heads are perfectly loose upon the shaft they will separate when the belt is operated. The directions of the paths of movement of said disks, if free, are indicated by the line C C, and the abutments to prevent such movement are indicated by the lines D D at right angles thereto. When, however, the belt is on the peripheral portions of said disks, if said disks were free the directions of the paths of movement are indicated by the lines C C of Fig. 10 and the abutments at right angles thereto by the lines D D. In Fig. 11 curved hubs E E are shown on the disks A A and are provided with curved stops F, forming corresponding shoulders that abut against projections G G, secured to the shaft. Thus when the heads are moved apart or toward each other they will when left in any position remain stationary with respect to the shaft, as the stops will bear against the portions of the walls that are in proper posi- 105



lar relation. However, should end pressure of abnormal degree be applied in either direction an additional end thrust will be created upon the heads, thus causing said heads to move longitudinally upon the shaft, and upon the release of such pressure the heads will remain in their newly-adjusted relations upon the shaft. These movements are taken advantage of in the adjustment of the pulleys.

Having thus explained the theory of the invention, the practical embodiment thereof, illustrated in the accompanying drawings, will now be described.

A suitable motor is employed, of which designate: the casing, and 11 the driving-shaft projecting from said casing and having a tapered portion 12, upon which a driving-pulley (designated as a whole by the reference-numeral 13) is attached. A driven pulley 14 is arranged in line with the driving-pulley and is connected therewith by a belt 15. The construction of the driving-pulley will be first described. A sleeve 16 is keyed upon the tapered portion of the shaft 11, being fastened in place by a suitable nut 17. This sleeve is provided in opposite sides with convergently-disposed slots 18, arranged obliquely to the axis of rotation of the shaft and curved longitudinally thereof, the walls of said slots constituting shoulders, as hereinafter set forth. Upon the sleeve 16 are fitted collars 19, that can revolve upon said sleeve and are also movable longitudinally toward and from each other thereon. These collars carry inwardly-projecting studs 20, upon the inner ends of which are journaled stop-rollers 21, that engage in the slots 18 and bear against certain of the said shoulders formed by the walls thereof. One of these collars is provided with slots 22, and fingers 23, carried by the other collar, slidably engage in the slots and serve to prevent independent rotation of said collars. Pulley-heads in the form of disks 24 are mounted upon the collars 19, being preferably formed with cuffs 25, that are screwed upon said collars, the inner cuff and disk being adjustable upon its collar and normally held against such adjustment by a set-screw 26. The collars are provided with means for urging them toward each other, said means being illustrated in Figs. 3 and 8. It will be seen that connections in the form of rods 27 are employed, which pass through the collars and have their ends located in seats 28 formed therein. The ends of the rods are provided with suitable heads 29, and coiled springs 30 are interposed between the heads and inner end walls of the seats.

Bearing in mind the preliminary explanation of the manner of stopping the movement of the pulley-heads, it is believed that the operation of this pulley will be clearly apparent. The slots 18 are curved longitudinally of the shaft or sleeve, and the walls thereof consti-

tute shoulders, different portions of which are thus located at different angles of obliquity to the axis of rotation of the pulley. This curvature or, in other words, these angles are so arranged with respect to the rollers 21 that the walls of the slot will always be at right angles to the lines of end thrust of the pulley-heads as transmitted to the rollers, and therefore said rollers act as stops, thus holding the pulley-heads and shaft against independent movement. The result is that the power is transmitted from the driving-shaft through the pulley to the belt.

In the present instance the structure is shown applied to a bicycle, and the pedal-shaft 31 constitutes the support for the driven pulley. This shaft is provided at its ends with pedal-cranks 32 and is journaled in ball-bearing boxes 33, hung in suitable brackets 34, secured to the bicycle-frame, the adjustment of the boxes being provided for by screws 35. Mounted upon the shaft and rotatable independently thereof is a hub 36, arranged upon suitable ball-bearings 37, carrying at one end a sprocket-wheel 38, by means of which power may be transmitted from the pulley to the driven wheel of the bicycle. The hub 36 is made in two parts, as shown in Fig. 2, and the outward end is provided with a cone clutching-face 39. Slidably mounted on the other end of the hub is a clutching-plug 40, which is also cone-shaped and is urged toward the clutching-face 39 by means of a coiled spring 41. A grooved wheel 42 is attached to the plug and designed to receive one end of an operating-lever which will permit the adjustment of said plug. The hub also carries a suitable brake-wheel 43. Arranged upon the hub is a sleeve 16<sup>a</sup>, having slots similar to those described in the sleeve 16 of the driving-pulley. The ends of these sleeves are beveled to coact with the clutching-faces of the hub and plug. The remainder of the pulley—namely, the portions mounted on the sleeve 16<sup>a</sup>—are similar in all respects to those described in the driving-pulley and are designated by the same reference-numerals. It is believed to be needless to redescribe these parts, as their construction and action are exactly the same. One additional feature, however, is to be noted, namely, that the cuff 25 of one of the pulley-heads is provided with a groove 25<sup>a</sup> to receive one end of an actuating-lever 25<sup>b</sup>. (Shown in Fig. 1.)

With the clutch mechanism above described the driven pulley may be unclutched from the hub which carries the sprocket-wheel 38, and consequently the motor will not effect the movement of the driven wheel. The pedals therefore or motor may be used independently. The operation of the device is as follows: As already described, under normal conditions the various heads are lo-



cated against movement with relation to themselves and their supports. This is due to the fact that the outward pressure upon said heads caused by the belt is stopped by the rollers bearing against the walls of the slots. No matter, therefore, in what position the heads are placed they will remain until moved, and this movement is accomplished by means of the actuating-lever 25<sup>b</sup>.

Assuming that the parts are in the relation shown in Figs. 1 and 2 and it being desirable to move the heads of the driven pulley together and at the same time, those of the driving-pulley apart, it will be evident that if pressure is applied through the medium of the actuating-lever to the heads of the driven pulley this pressure, together with that of the tension-springs urging the heads toward each other, will overbalance the outward pressure upon the heads caused by the belt. As a result the heads will move simultaneously toward each other because of the interlocking fingers, and they will also rotate upon the supporting-sleeve. This extra pressure caused by the belt running up on the inclined faces will impart an abnormal pressure to the heads of the driving-pulley and in addition to the usual strain of the pulley will overcome the balancing effect of the springs, thereby causing the heads of said driving-pulley to separate. The various movements will continue until pressure upon the actuating-lever is released, whereupon the parts will become balanced and will remain in their new relative positions. If it should become desirable to again increase the speed of the driven shaft, the actuating-lever is moved outwardly, and thereby the parts again becoming unbalanced the heads will separate and cause the belt to loosen. The pulling action therefore becoming weakened on the driving-belt, the tension-spring will overbalance the same and cause the heads thereof to move toward each other.

Where sleeves, as shown in Fig. 4, are employed, the pulleys can move in one direction only, for should an attempt be made to reverse their direction of movement the heads would immediately spread. In Fig. 5, however, there is illustrated an arrangement which may be used in a reversible pulley. The sleeve in this form is designated 16<sup>b</sup>, and the slots 18<sup>a</sup> therein are so constructed that their opposite walls converge, and thus when the reversal of movement takes place the stops will simply move to the opposite walls and will immediately be arranged in coacting relation again.

It will be observed that this structure has reduced friction because of thrust-bearings, for the parts all rotate together and a great amount of power is thus saved. The elementary parts necessary to secure the co-operation are few and simple, and, further-

more, the structure as a whole is exceedingly compact. The parts are housed from dust and dirt, the roller-stops being completely inclosed and the balancing-springs 30 being also housed. Moreover, the construction is such that the parts can be adjusted to take up wear and looseness in the belt, and, if desirable, by means of the adjustable heads the spaces between the heads can be contracted to obtain a greater grip upon the belt.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention. For instance, while the structure is herein shown and described in connection with one form of pulley only it will be understood by those skilled in the art that the invention can be employed in connection with expansible pulleys of other types.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a rotatable supporting member, of an expansible pulley having a member rotatably mounted on the supporting member and movable longitudinally thereof, a shoulder carried by one member and disposed obliquely to the axis of rotation of the member, and a stop carried by the other member and bearing against the shoulder.

2. The combination with a rotatable supporting member, of an expansible pulley having a member rotatably mounted on the supporting member and movable longitudinally thereof, a shoulder carried by one member and disposed obliquely to the axis of rotation of the members, and a roller-stop journaled upon the other member and bearing against the shoulder.

3. The combination with a rotatable supporting member, of an expansible pulley having spaced members rotatably mounted on the supporting member and movable longitudinally thereon toward and from each other, convergently-disposed shoulders carried by the supporting member, and stops carried by the pulley members and bearing against the converging shoulders.

4. The combination with a rotatable supporting member, of an expansible pulley having spaced members rotatably mounted on the supporting member and movable longitudinally thereon toward and from each other, convergently-disposed shoulders carried by the supporting member, and roller-stops journaled upon the pulley members



and bearing against the converging shoulders.

5. The combination with a rotatable supporting member, of an expansible pulley having a member rotatably mounted on the supporting member and movable longitudinally thereon, a shoulder carried by one member and disposed obliquely to the axis of rotation of the members, different portions of the shoulder being arranged at different angles of obliquity, and a stop carried by the other member and bearing against the shoulder.

6. The combination with a rotatable supporting member, of an expansible pulley having a member rotatably mounted on the supporting member and movable longitudinally thereon, a shoulder carried by one member and disposed obliquely to the axis of rotation of the members, said shoulders being curved longitudinally of the member whereby the various portions thereof are disposed at different angles of obliquity, and a stop carried by the other member and bearing against the shoulders.

7. The combination with a rotatable supporting member having an obliquely-disposed curved shoulder, of an expansible pulley, including a member rotatably and longitudinally movable on the supporting member, said pulley member having a movable stop that bears against the shoulder.

8. The combination with a rotatable supporting member having an obliquely-disposed shoulder that is curved longitudinally of said supporting member, of an expansible pulley, including a member rotatably and longitudinally movable on the supporting member, said pulley member having a movable roller-stop journaled thereon and bearing against the oblique shoulder.

9. The combination with a rotatable supporting member having obliquely-disposed converging shoulders that are curved longitudinally of the member, of an expansible pulley, including members that are rotatable and movable longitudinally upon the supporting member, and stops carried by the pulley members and bearing respectively against the shoulders.

10. The combination with a rotatable supporting member having an obliquely-disposed shoulder that is curved longitudinally of the member, of an expansible pulley, including a disk having an inclined face, said disk being revoluble and longitudinally movable upon the supporting member, and a stop carried by the disk and engaging the shoulder.

11. The combination with a rotatable supporting-sleeve having a slot provided with a wall that is located diagonally of the axis of rotation of the sleeve, of an expansible pulley, including a disk rotatably mounted on

the sleeve and movable longitudinally thereof, and a stop carried by the disk and bearing against the diagonal wall of the slot.

12. The combination with a rotatable supporting-sleeve having a slot provided with a wall that is located diagonally of the axis of rotation of the sleeve, of an expansible pulley, including a disk, a collar carried by the disk, said collar being rotatably mounted on the sleeve and movable longitudinally thereof, and a stop-roller journaled upon the collar and bearing against the diagonal wall of the slot.

13. The combination with a rotatable supporting-sleeve having shoulders that are diagonally and convergently disposed, of disks revolubly mounted on the sleeve and movable toward and from each other, said disks having inclined opposing faces, and projections connected with the disks and engaging the shoulders.

14. The combination with a rotatable supporting-sleeve having slots forming shoulders, said shoulders being diagonally and convergently disposed, of collars revolubly mounted on the sleeve and movable toward and from each other, said collars carrying disks that have inclined opposing faces, and inwardly-extending projections carried by the collars and engaging the shoulders.

15. The combination with a rotatable supporting member, of pulley-disks rotatably and longitudinally movable toward and from each other upon the supporting member, means for holding the disks against movement on the supporting member, and slidably-associated interlocking connections between the inner portions of the disks.

16. The combination with a rotatable supporting member, of collars rotatably and longitudinally movable toward and from each other upon the supporting member, means for holding the collars against movement on the supporting member, and disks carried by the collars and having inclined opposing faces, said collars having slidably-associated interlocking connections.

17. The combination with a rotatable supporting member, of collars rotatably and longitudinally movable toward and from each other upon the supporting member, means for holding the collars against movement on the supporting member, one of the collars having sockets, there being fingers carried by the other collar and slidably engaging in the sockets.

18. The combination with a rotatable supporting-sleeve having convergently-disposed slots, of collars rotatably mounted on the supporting-sleeve and movable toward and from each other, rollers journaled upon the collars and engaging in the slots of the supporting-sleeve, fingers carried by one collar



and slidably engaging the other, and outstanding disks secured to the collars and having inclined opposed inner faces.

19. The combination with a support, of pulley-sections movable toward and from each other upon the support, stops for normally preventing the relative movement of the sections away from each other, and a spring for urging them toward each other.

20. The combination with a rotatable support, of pulley-sections rotatable and movable toward and from each other upon the support, stops for normally preventing the rotation of the sections upon the support, and a spring for urging the sections toward each other.

21. The combination with a support, of pulley-sections movable toward and from each other upon the support, and a spring-pressed connection between the sections and independent of the support for urging them toward each other.

22. The combination with a support, of pulley-sections movable toward and from each other upon the support, a rod connecting the sections, and a spring mounted on the rod and bearing against one of the sections to urge said sections together.

23. The combination with a support, of pulley sections mounted upon the support and movable toward and from each other, a rod slidably connecting the sections, and springs on the ends of the rod for urging the sections toward each other.

24. The combination with a rotatable support, of pulley-sections rotatable and movable toward and from each other upon the support, stops for normally preventing the relative movement of the sections away from each other, spaced rods connecting the sections, and springs mounted on the rods for urging the sections toward each other.

25. The combination with a rotatable support, of pulley-sections rotatably mounted on the support and movable toward and from each other, spaced fingers connecting the sections to prevent their independent rotation, and spring connections between the sections, said connections being located between the fingers.

26. The combination with a revoluble pulley member having an expansible belt-carrying portion, and a relatively movable revoluble supporting member for the pulley member, of a curved shoulder revoluble with the pulley and disposed substantially concentric to the axis of rotation thereof, said shoulder being arranged transversely to the line of end thrust of the expansible portion of the pulley, and a stop bearing against the shoulder, the stop being carried by one member and the shoulder by the other member.

27. The combination with a rotatable sup-

port, of collars mounted upon the support and movable toward and from each other, said collars having transverse seats, a rod connecting the collars and having its ends arranged in the seats, springs housed within the seats and bearing against the rods, and pulley-heads carried by the collars.

28. The combination with a rotatable support, of collars mounted upon the support and movable toward and from each other, and pulley-head disks, one of which is adjustably mounted on one of the collars.

29. The combination with a rotatable support, of collars rotatable with the support and movable toward and from each other thereon, pulley-head disks carried by the collars, one of said disks having a threaded engagement with one of the collars, and a set-screw for holding the head-disk against movement on its collar.

30. The combination with a supporting member, of a pulley including a head having a spiral path of movement upon the supporting member, means for limiting said head to such path of movement, and means for moving the head, said supporting member and head being rotatable with respect to the moving means.

31. The combination with a supporting member, of a pulley including a head having a spiral path of movement upon the supporting member, means for limiting said head to such path of movement, and means for exerting a pressure upon the head longitudinally of the supporting member to cause said head to move in its spiral path, said supporting member being rotatable with respect to the moving means.

32. The combination with a supporting member, of a pulley including heads that are movable toward and from each other in spiral paths about the supporting member, and means connecting the heads to the supporting member to normally hold said heads in fixed relative positions with respect to each other and to the supporting member, said means permitting the heads to travel toward and away from each other in said spiral paths of movement, when abnormal thrust is applied to the heads.

33. The combination with a rotatable supporting member, of a pulley including heads that are movable toward and from each other in spiral paths upon the supporting member, said heads having inclined faces, a belt operating upon said faces, means connecting the heads to the supporting member to normally hold said heads in different fixed relative positions to each other and to the supporting member when under the belt tension, said means permitting the said heads to travel toward or away from each other in said spiral paths of movement when abnormal end



thrust is applied to the heads, and means for delivering such end thrust.

34. In a speed-varying mechanism of the type described, the combination with a shaft,  
5 and a pair of cone-shaped driving-disks mounted thereon and both axially and angularly movable relatively thereto, of a driving connection between the shaft and disk capable of relative angular displacement, where-  
10 by relative angular displacement between

the disks and shaft will cause opposite axial movement of the two disks upon the shaft.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LUTHER A. LOHR.

Witnesses:

JOHN H. SIGGERS,  
S. GEORGE TATE.