No. 861,405. PATENTED JULY 30, 1907.

H. R. STACKS.

VARIABLE SPEED MECHANISM.

APPLICATION FILED AUG. 19, 1905.

5 SHEETS—SHEET 1.

Fig. 1.

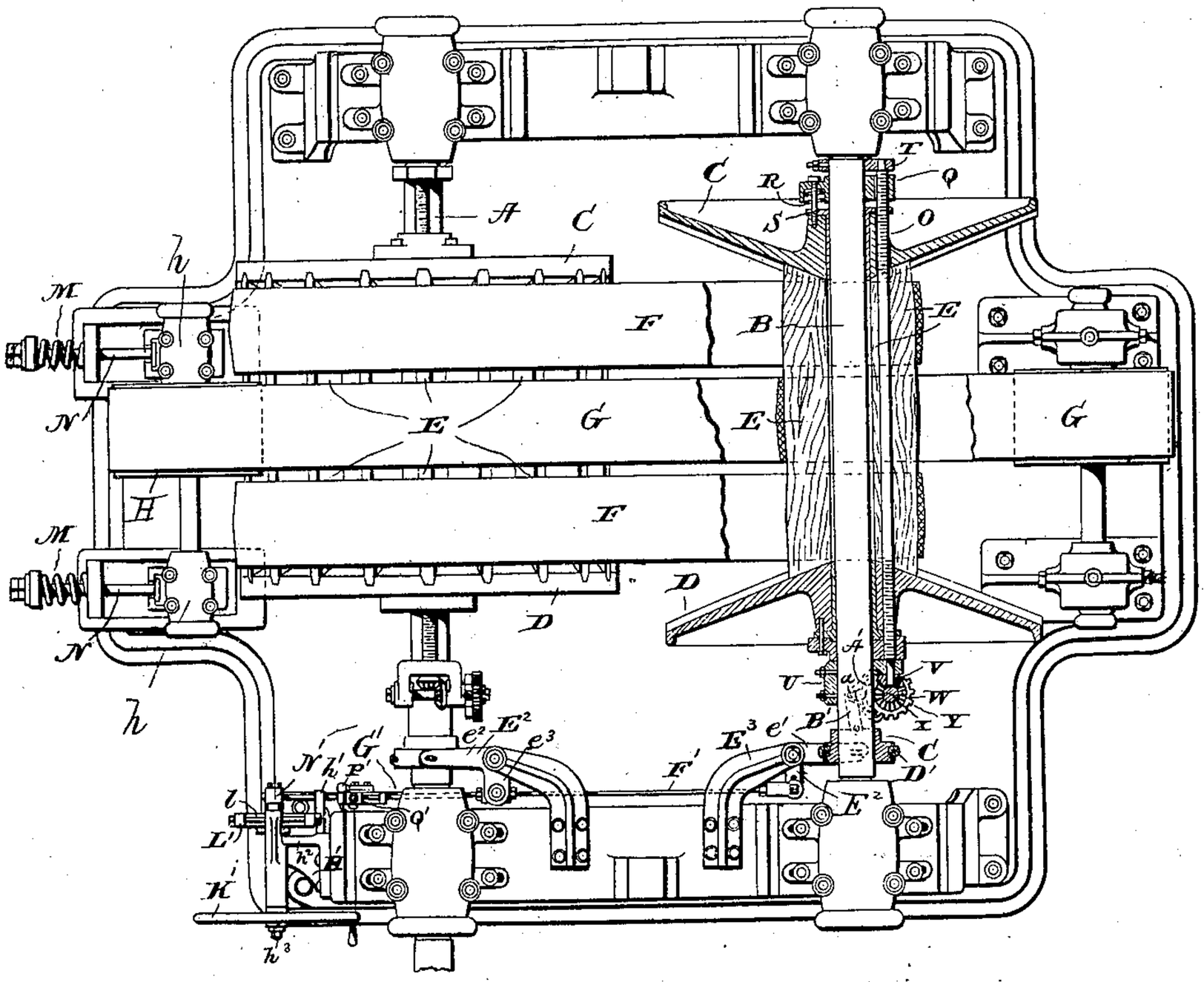
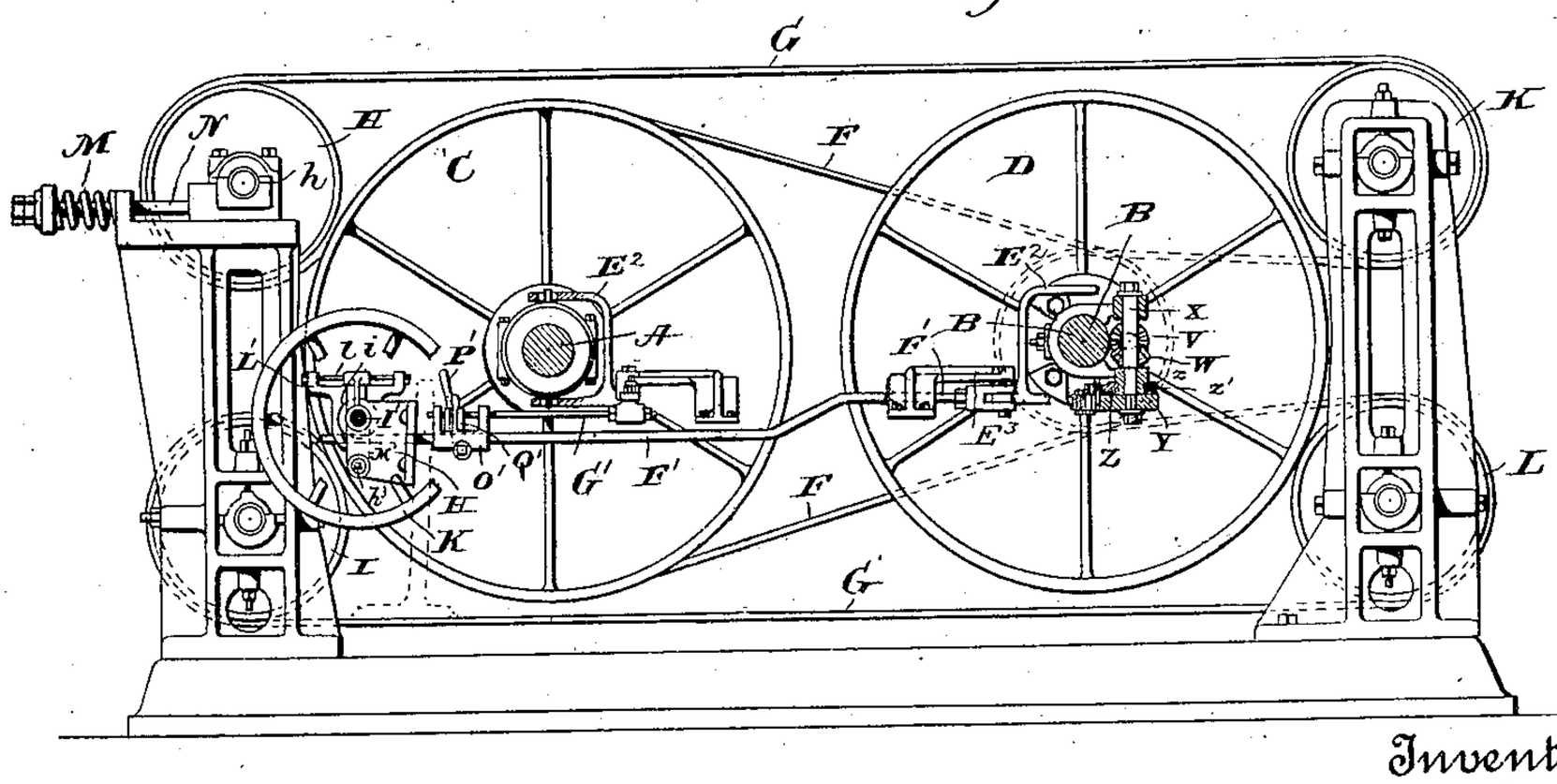


Fig. 2.



Witnesses

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5 SHEETS—SHEET 2.

Fig. 5.

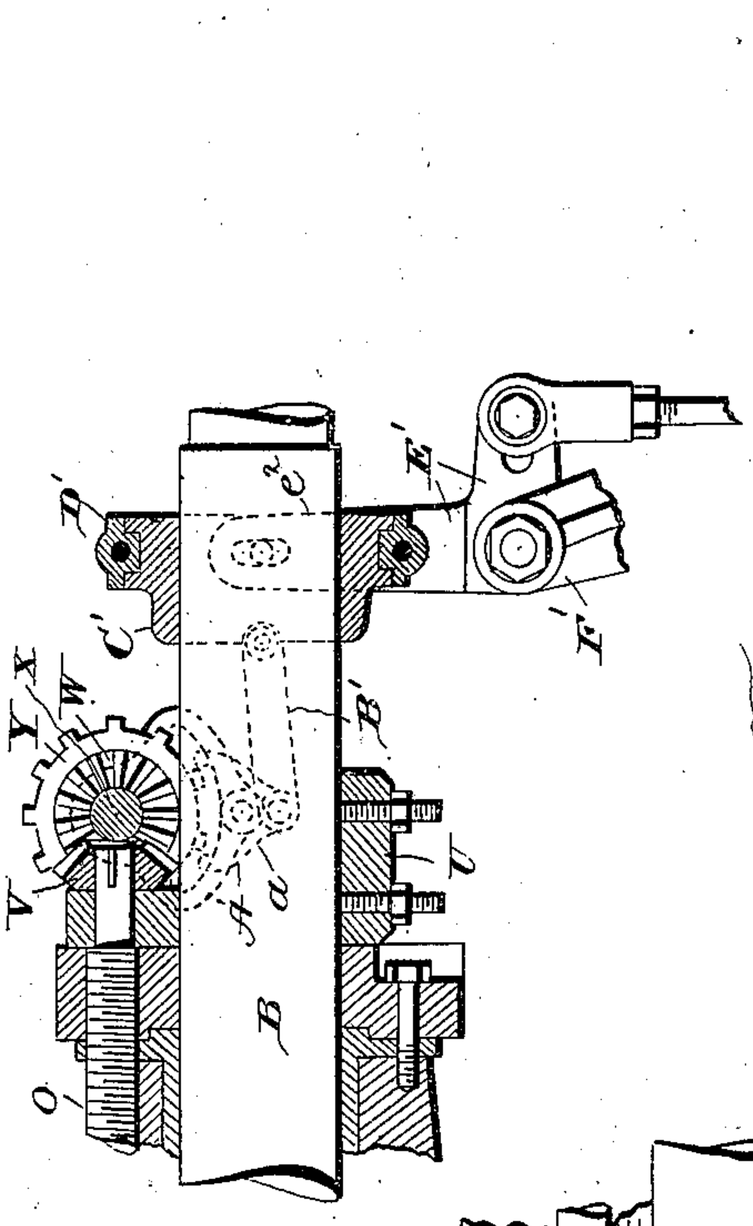


Fig. 6.

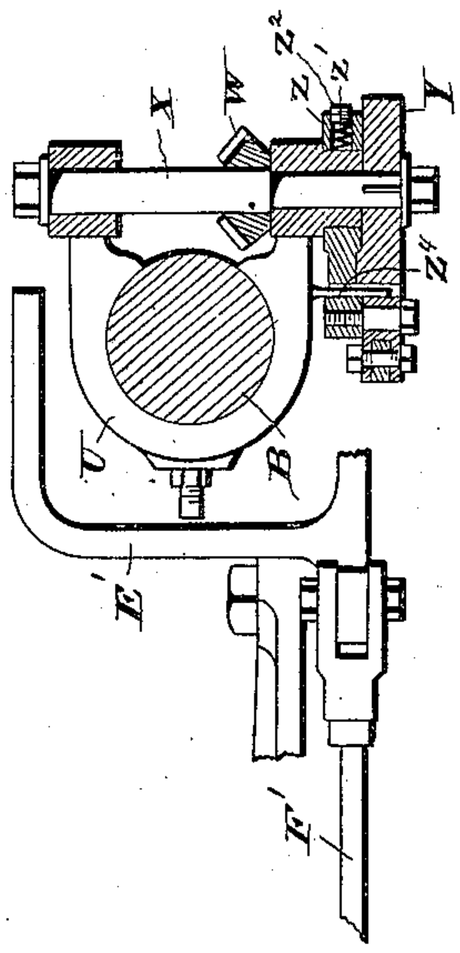


Fig. 3.

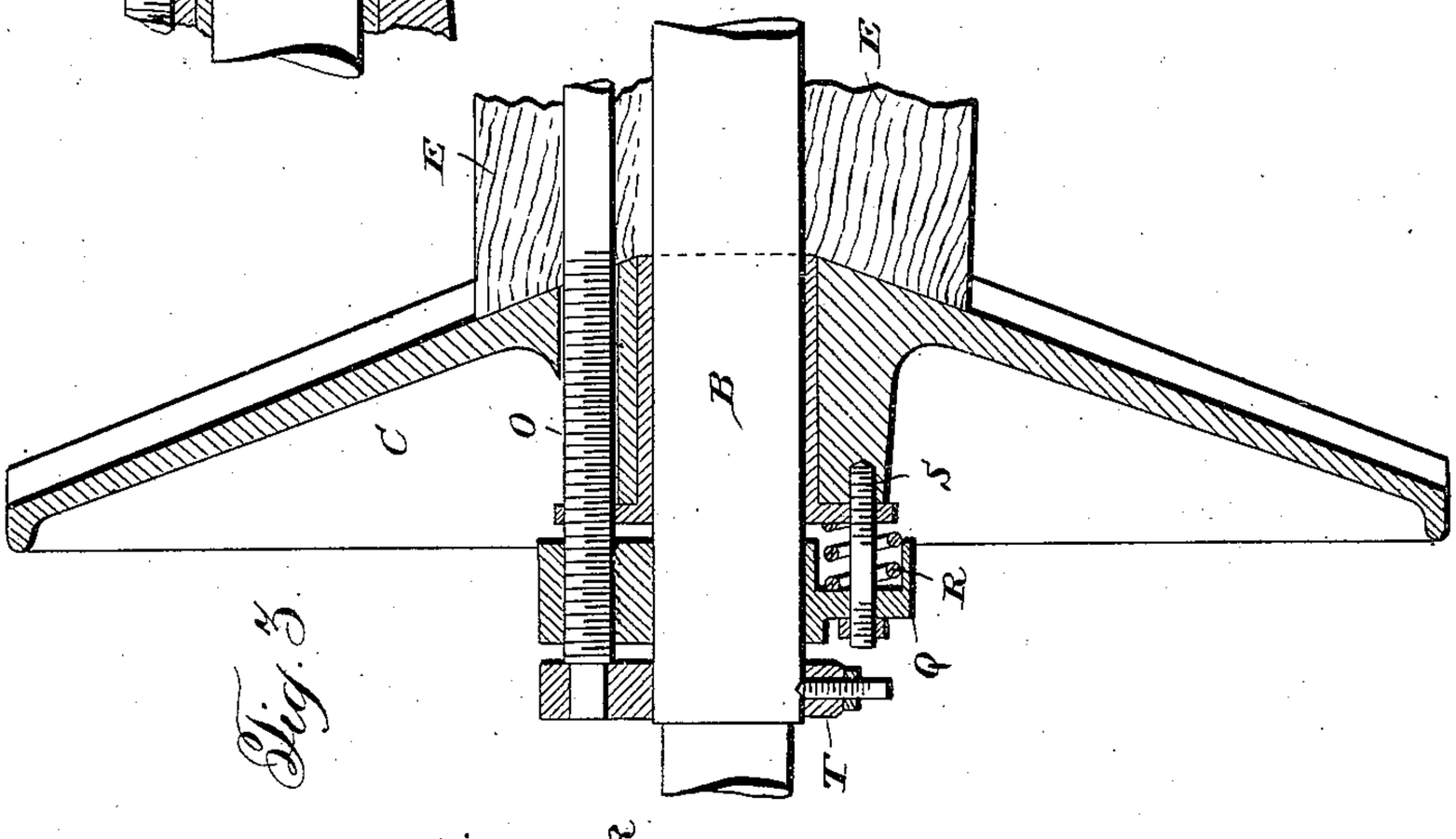
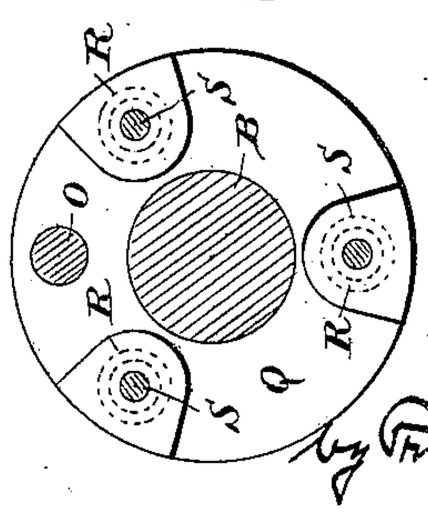


Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 7.

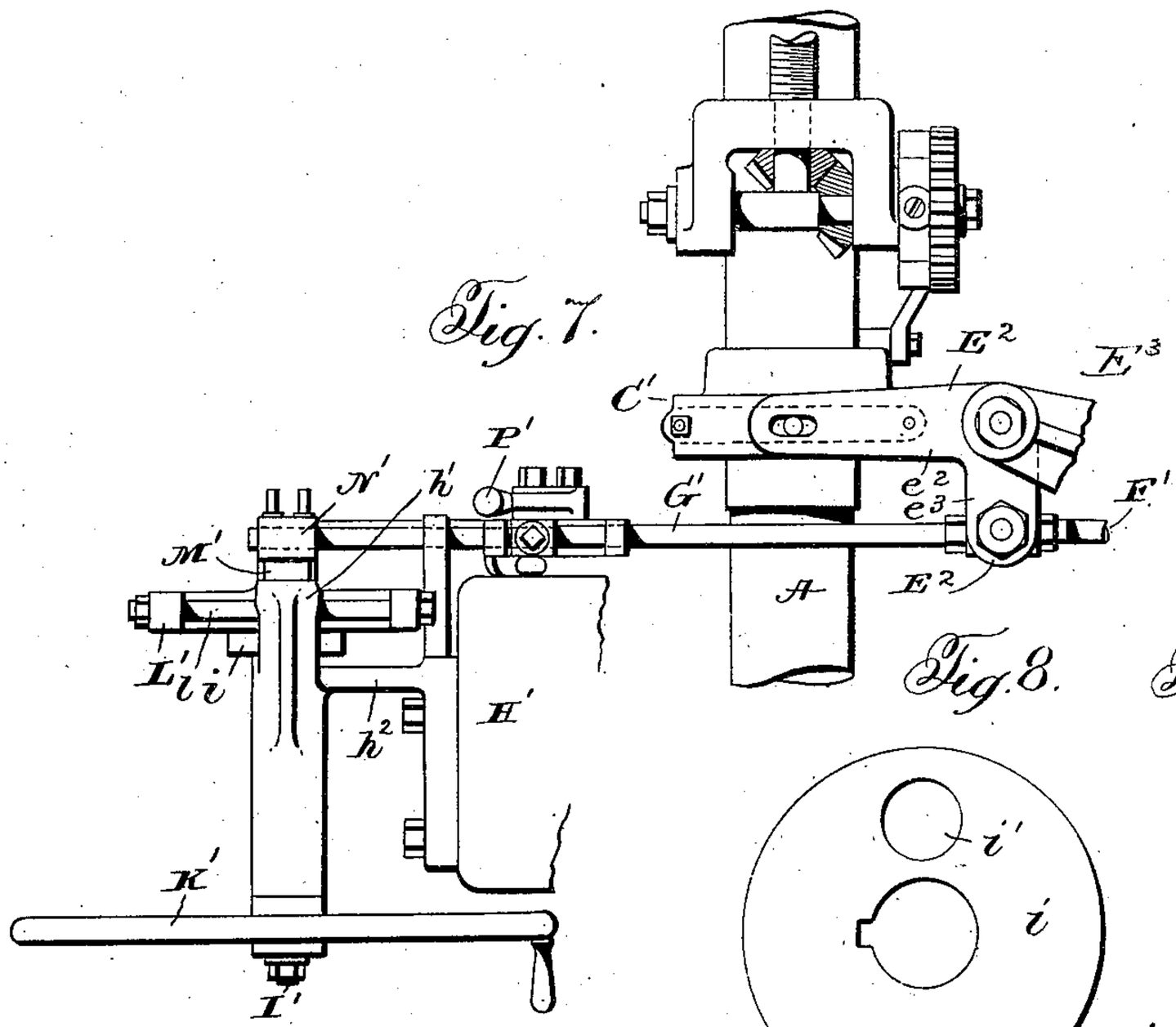


Fig. 8.

Fig. 9.

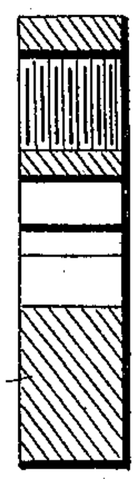
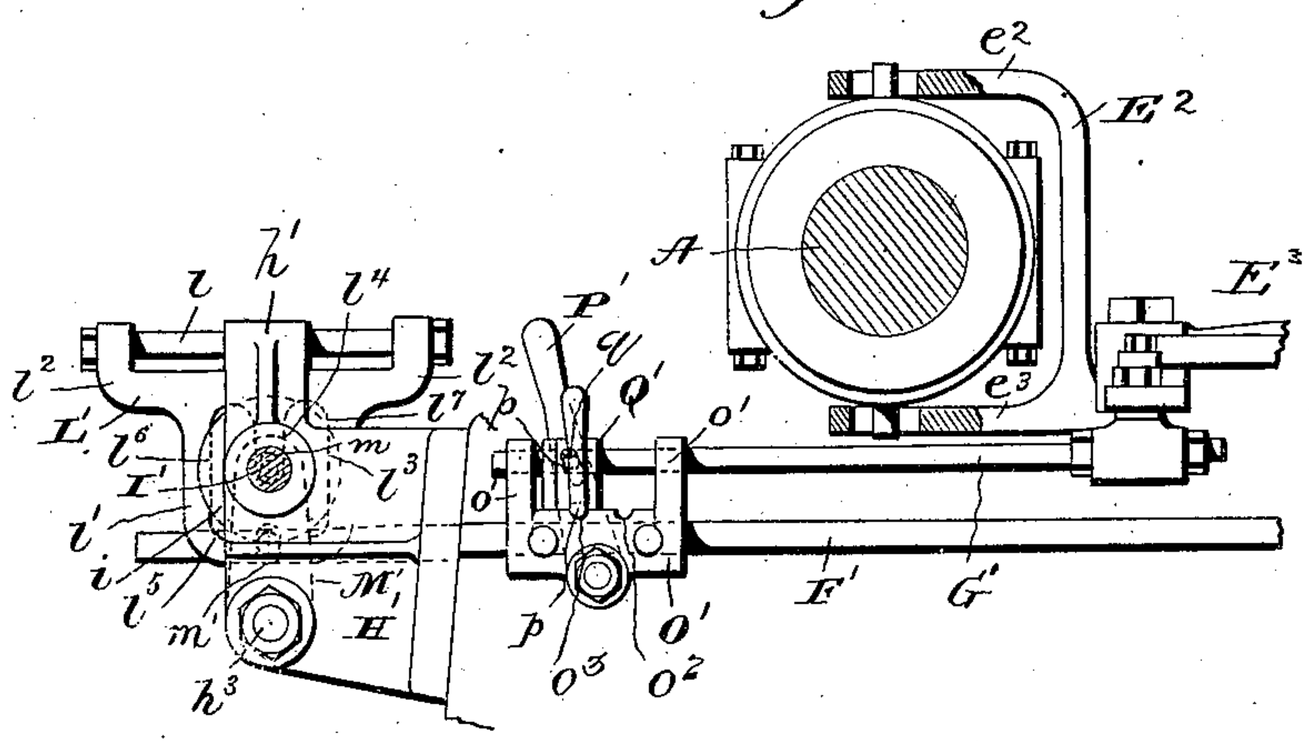


Fig. 10.



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5 SHEETS—SHEET 4.

Fig. 11.

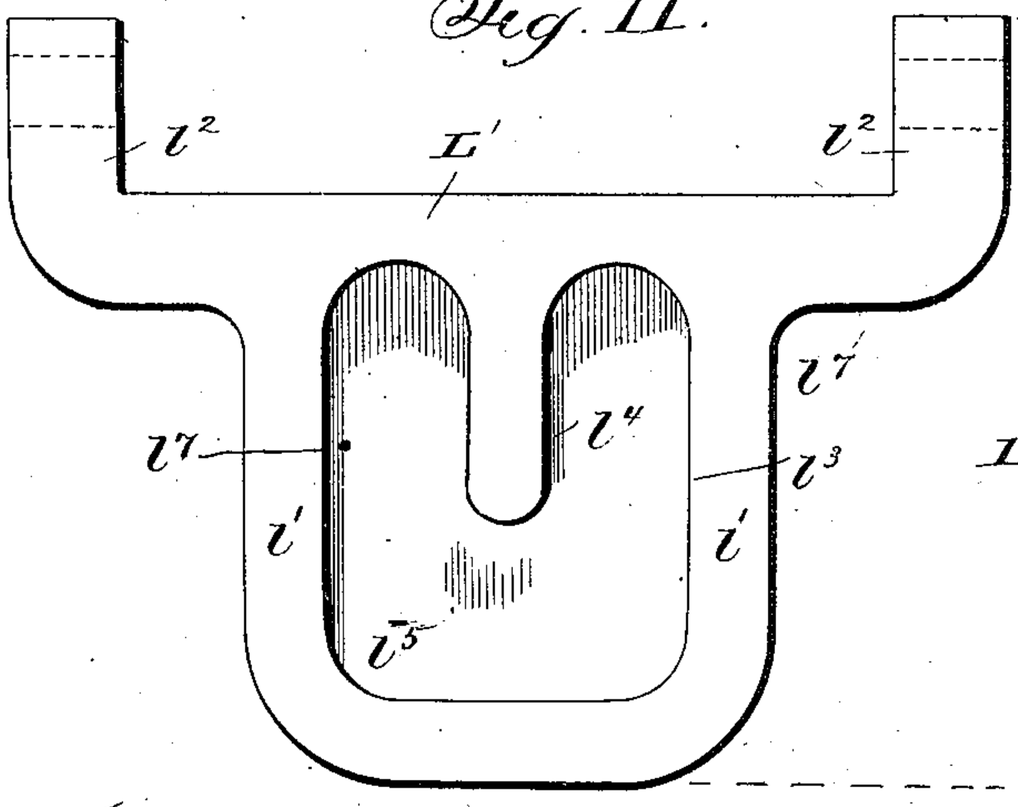


Fig. 12.

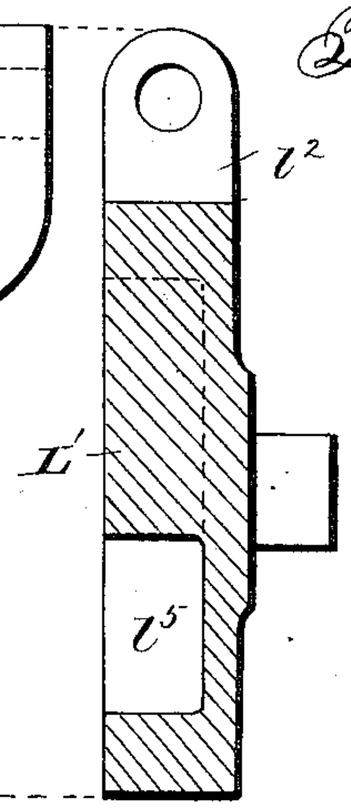


Fig. 13.

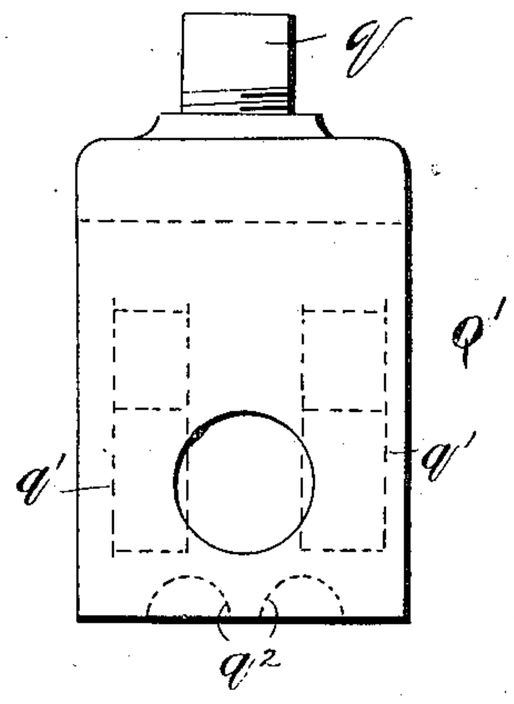


Fig. 14.

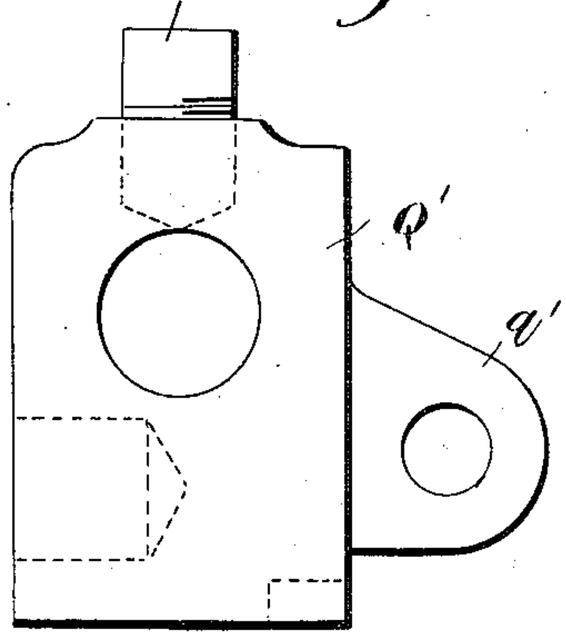


Fig. 15.

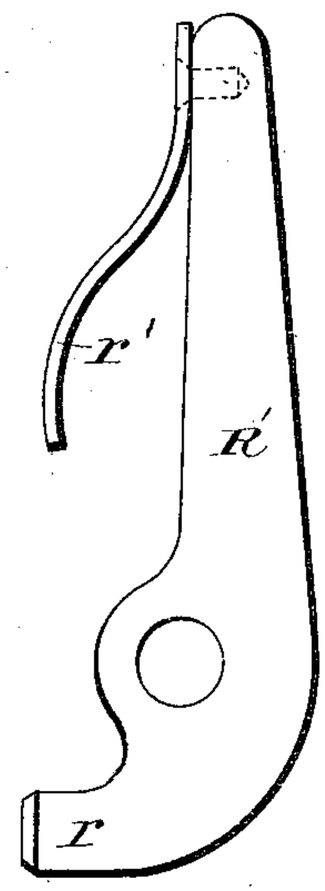


Fig. 16.

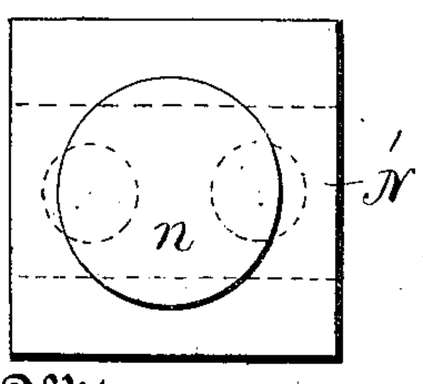
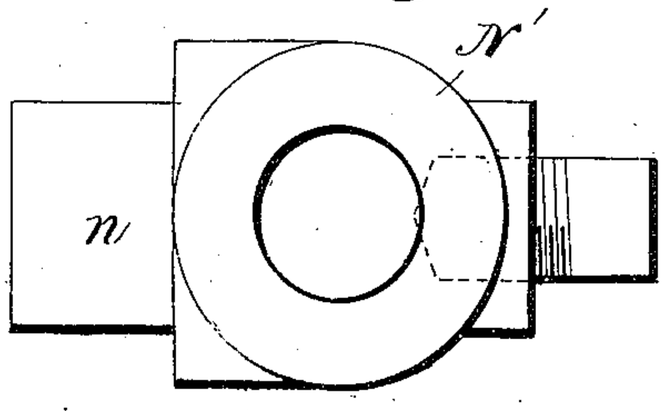


Fig. 17.



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APPLICATION FILED AUG. 19, 1905.

5 SHEETS—SHEET 5.

Fig. 18.

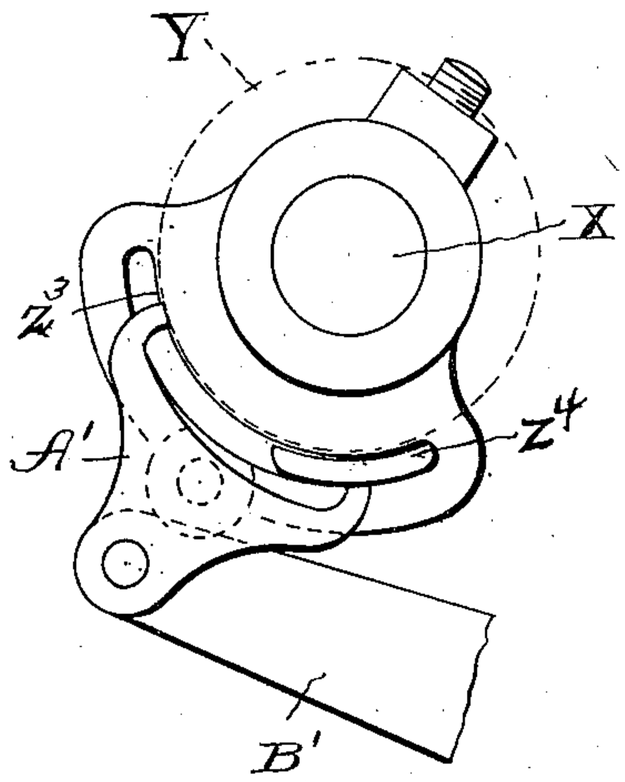


Fig. 19.

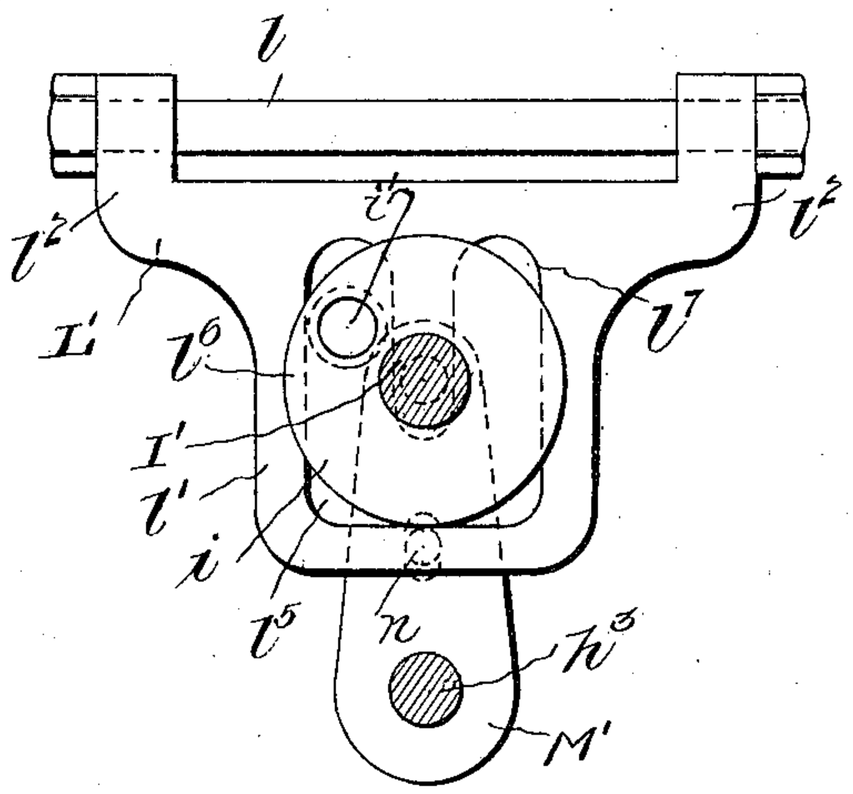
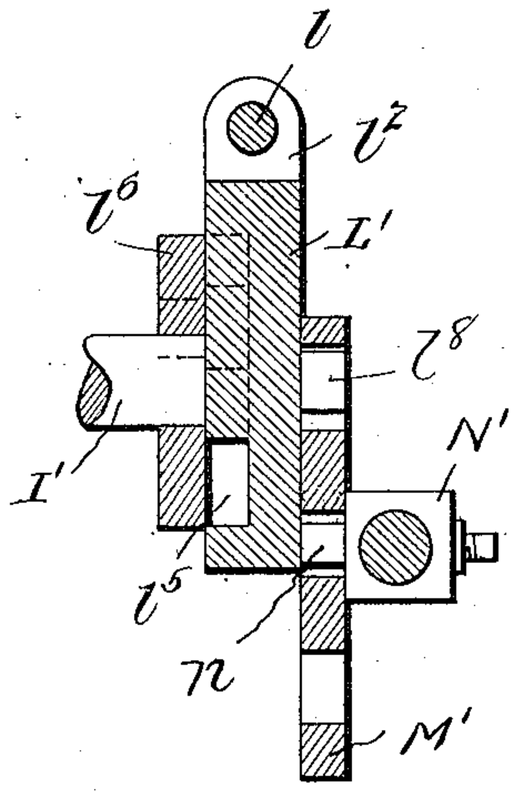


Fig. 20.



Witnesses

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UNITED STATES PATENT OFFICE.

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VARIABLE-SPEED MECHANISM.

No. 861,405. Specification of Letters Patent. Patented July 30, 1907.

Application filed August 19, 1905. Serial No. 274,915.

To all whom it may concern:

Be it known that I, HOWARD ROY STACKS, of Philadelphia, in the county of Philadelphia, and in the State of Pennsylvania, have invented a certain new and useful Improvement in Variable-Speed Mechanisms; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a variable-speed mechanism embodying my invention; Fig. 2 is a side elevation of Fig. 1; Fig. 3 is a detail view of the crank shaft and adjacent parts for actuating the regulating devices, Figs. 4, 5 and 6 are detail views; Fig. 7 is a detail in plan view of the operating mechanism for the pawl and ratchet; Figs. 8 and 9 are respectively an elevation and vertical section of the crank disk; Fig. 10, is an elevation partly in section of Fig. 7; Figs. 11 and 12 are respectively a side elevation and vertical section of the controller cam; Figs. 13 and 14 are respectively a front view, and end elevation of the latch slide; Fig. 15 is a side view of the latch; Figs. 16 and 17 are respectively a front view and an end elevation of the fulcrum block for the lever for shifting the latch slide; Fig. 18, a detail view of a portion of the disk shifting mechanism, Figs. 19 and 20 are respectively a front view and a vertical sectional view of the controller cam together with the crank disk and lever connected therewith.

The object of my invention has been to provide a mechanism by which a variable speed may be communicated to a driven shaft from a constant speed driving shaft, which mechanism shall have a maximum of efficiency and shall be capable of operation with certainty and convenience, and to such ends, my invention—consists in the variable speed mechanism hereinafter specified.

In carrying my invention into practice, I provide a frame having bearings in which are journaled two parallel shafts A and B, respectively, either of which may be the driving shaft, and the other the driven shaft. Upon each shaft is mounted a pair of opposing conical disks C and D, each of which disks has radial grooves that are adapted to receive the opposite ends of slats E, the latter being formed, preferably, of wood. Driving belts F are mounted upon the said slats near their outer ends, each belt passing around the cylinder of slats formed on each shaft. A retaining belt G passes around upper and lower idler pulleys H and I and K and L, respectively, at each end of the frame, and such belt passes around the adjacent portions of the peripheries of the cylinders of slats which portions are not engaged by the driving belts, and such retaining belt serves to hold the slats in position over the portion of their travel where they are not so engaged by the driving belts. One pair of guide pulleys, for instance the pulleys H, is preferably mounted in sliding bearings *h*, which are yieldingly drawn outward by springs M which encircle bolts N secured to the said bearings and passing through lugs on the frame. This arrangement insures that the retaining belts shall be under proper tension. So much of my invention is described in my previous application, Serial No. 208,680, filed May 19th, 1904.

In order to change the ratios of the diameters of the cylinders of slats, it is necessary to cause one pair of conical disks to approach each other and the other pair to correspondingly recede from each other, and it is desirable to do this in such a way that the parts which hold the disks in their adjusted positions shall have no motion relative to each other, so that the loss of power, due to the friction of parts under strain, shall be avoided. To adjust the disks toward and from each other, I provide each pair with a screw O, such screw being threaded at its opposite ends in opposite directions. The screw engages the disk D, directly, by a thread formed in its hub, but it passes freely through a bore in the hub of the disk C and engages a thread in a disk Q that is, like the disks C and D, splined on the shaft. A spring R is seated in a recess formed in the disk Q and bears against the hub of the disk C. A bolt S passes through the disk Q and is threaded into the said hub and serves to limit movement of the conical disk away from the disk Q. If desired, and as I prefer, a series of three springs R is used between the disk Q and the conical disk C. The spring or springs R yieldingly force the disks C and D toward each other, and thus yieldingly put the driving belts under tension. The screw O is preferably journaled at the end which passes through the disk Q in a collar T that is fastened to the shaft, as by a set screw. At its opposite end the screw is journaled in a bearing frame U that is also secured to the shaft, preferably by set screws. The screw shaft O passes through the bearing frame U and has a miter gear V keyed to its projecting end. The miter gear V meshes with a miter gear W which is keyed on a short shaft X that is journaled in ears formed on the bearing frame U. On the lower end of the shaft X is keyed a ratchet wheel Y, the latter preferably having rectangular teeth. A pawl carrier Z is mounted on a cylindrical portion of the ear nearest the ratchet wheel, and some resistance is offered to its turning on the said ear by a washer *z* that is forced down upon the journal formed on the said ear by a spring *z'* mounted in a socket in the pawl-carrier, the tension of the

spring being regulated by a screw z^2. The pawl-carrier is provided with an arc-shape slot z^3, which receives a pawl shield z^4 on the bearing bracket U, such projection serving to limit the motion of the pawl-carrier relative to the said bracket. A double pawl A′ is pivoted on the pawl-carrier, and an arm a of the pawl is connected by a link B′ with a pin on a thimble C′ that is splined upon the shaft B. The said thimble has a trunnion collar D′ that is seated in a groove in the peripherv of the said thimble. The trunnions of the said collar are engaged by slots in the upper and lower arms e and e' of a bell crank lever E^2 that is fulcrumed on a bracket E^3 secured on the frame. The shaft A, together with its cone pulleys and adjusting devices, is, in all respects, like the shaft B, in so far as described, and the devices on the shaft A will, therefore, not be described in detail.

The trunnion-engaging arms of the bell crank E^2 of the shaft A extend in the opposite direction from the fulcrum of the bell crank from that of the said arms of the bell crank E′, but the power arms e^2 and e^3 of the respective bell cranks are parallel to the said shafts and upon the same side of their fulcrums. The power arm e^2 is swiveled to an operating rod F′, and the power arm e^3 is swiveled to an operating rod G′. The rod F′ extends under the shaft A and is guided in an arm h' that is formed on the bracket H′, which latter is secured to the pillar which supports the adjacent bearing of the shaft A. A crank shaft I′, which is journaled in the bracket H′, carries a crank disk i on the end nearest the rod F′, the said disk having a crank pin i'. The opposite end of the shaft I′ is provided with a hand-wheel K′. The bracket H′ is provided with a horizontal guide h', in which is mounted the guide rod l of a controller cam L′. The controller cam consists of a body l' that is suspended from the guide rod by arms l^2, in which are mounted the ends of the guide rod. The cam l^3 is formed in the face of the body l' which is adjacent to the crank disk. Such cam consists of a central projection l^4 having a space l^5 beneath it for the passage of the crank pin, and having vertical walls l^7 parallel to the projection and upon each side thereof, which are adapted to be struck by the crank pin. The bracket H′ also has a fulcrum pin h^3 directly beneath the crank shaft, on which is mounted a lever M′, the said lever having an elongated slot m near its upper end that receives a pin l^8 projecting from the face of the cam body opposite to that having the cam formed in it. Intermediate its ends the lever M′ has a slot m' that is adapted to receive a pin n that projects from a block N′ which is secured upon the rod F′. The rod G′ is operated by being connected with the rod F′ and, for purposes to be later explained, the connection between the two rods is made adjustable. A bracket O′ is mounted upon the rod F′, as by having a hole formed therein that is adapted to receive the said rod, and having set screws to secure it upon the said rod. Said bracket has vertically extending arms o', the latter having holes that are adapted to receive the rod G′. A lever P′ is fulcrumed on a pin carried by the lower portion of the bracket O′, and such lever projects upward above the rod G′. The said rod is provided with a slide Q′ that is secured to the said rod between the ears o'. The slide Q′ carries a pin q that engages a slot p in the lever P′, whereby the said slide may be shifted by means of the said lever. A latch R′ is fulcrumed between ears q' on the slide Q′ and has a finger r that is adapted to be projected, by means of a spring r' carried by the said latch and bearing against the said slide, into a half-round socket q^2 formed in the under surface of the slide, when the said socket is in coincidence with either of two half round sockets o^2 and o^3, respectively, formed in the upper surface of the body of the bracket O′, the slide Q′ thus being capable of being locked in either of two positions, according to whether one or the other of the sockets in the bracket O′ is engaged by the latch R′.

In the operation of my mechanism, assuming the shaft A to be the driving shaft, and supposing it to be desired to reduce the speed of the driven shaft, and assuming the latch R′ to be in engagement with the socket o^2, which is the one nearest the shaft B, and which, consequently, gives the greater distance between the power arms of the bell crank levers, the hand-wheel K′ is given a left-hand rotation, or opposite to the hands of a clock. This causes the crank pin to operate on the right hand side of the projection l^4 of the controller cam and on the vertical surface l^6, causing the controller cam to reciprocate with each rotation of the crank shaft, but within limits that are away from the bell cranks relative to the central position of the cam. The bell cranks are thus swung on their fulcrums, and the thimble of the shaft B is caused to reciprocate toward the conical disks. This action carries the links B′ toward the said disks and causes the pawl A of the said shaft to swing upon its fulcrum pin on the pawl-carrier, the latter being held stationary during this movement by the friction caused by the spring z'. The tooth of the pawl on the shaft B nearest the conical disks is thus brought into engagement with the ratchet wheel of such shaft, and such wheel is moved a step in a direction tending to unscrew the screw shaft O from the conical disks and causing them to approach each other. Centrifugal force and the action of the conical disks causes the slats E to travel outward and increase the diameter of the cylinder which they form. While this action has been occurring with the parts carried by the shaft B, the bell crank lever E^2 of the shaft A has moved its thimble away from the conical disks on such shaft and has caused the opposite action of the pawl carrier and screw shaft from that described in connection with the shaft B, causing the conical disks of the shaft A to recede from each other, so that the diameter of the cylinder formed by the slats on the said shaft is decreased, corresponding to the increase of diameter of the cylinder of slats on the shaft B. On the retracting movement of the thimbles, the pawls are prevented from engaging the teeth of the ratchet wheels by the contact of the pawl tooth, not being used, with the shield z formed on the bearing frame U. The said shield is curved concentric to the axis of the ratchet wheel, and, when the pawl-carrier is turned to one side of the center of the shield by the engagement of one pawl, the other pawl, being brought over the shield by such action, is prevented from engaging the ratchet wheel, so long as the pawl-carrier is not brought back to its central position. In this manner, the disks of

one pair of conical disks are made to approach each other, and the disks of the other pair to recede from each other by the turning of the hand-wheel.

If it is desired to change the diameters of the cylinders of slats in the opposite direction, that is, to decrease the diameter of the cylinder of slats on the shaft B, and to increase it on the shaft A, the hand-wheel is merely turned in the opposite direction; that is, it is turned with the hands of a clock, and the crank pin engages the central projection l^4 of the controller cam and throws such cam to the opposite side of its central position, namely, toward the bell cranks, and then causes a series of reciprocations of the controller cam in that field of its movements, by means of alternate contacts with the vertical surface l^7 and the adjacent face of the projection l^4. This action causes the pawl carriers to swing to the opposite sides of the centers of the shields from those on which they swing during the adjustment above described, and causes the opposite pawl teeth to engage the ratchet wheels, giving movements to the screw shafts opposite to those before described, and thus causing a decrease in the diameter of the cylinder of slats on the driven shaft and an increase in the diameter of the cylinder of slats on the driving shaft.

When it is desired to lock the adjusting mechanism to prevent any tendency to "back off", or to unscrew, the latch R′ is engaged with the socket q^2, thus shortening the connection between the power arms of the bell cranks. This causes the pawls to engage the ratchet wheels on the same sides of the centers of the shields, instead of on opposite sides, as heretofore, and thus tends to increase the diameter of both cylinders of slats, instead of increasing one diameter and decreasing another, as heretofore, and thus prevents the backing down.

The driving belts are kept under sufficient tension by an adjustment of the relative positions of the screw shafts, so that the springs R are always under tension. Such springs thus provide for any slight change in the length of the belts due to their stretching, or due to an increased load.

It will be observed that the actuating mechanism of my variable speed mechanism imposes no appreciable friction on the bearings of the mechanism. There is no relative motion between the parts, (except when an adjustment is being effected,) except the motion between the thimbles and their trunnion rings; and, as there is no strain on the thimbles, except to hold the pawls in the desired position, such friction is so small as to be entirely unimportant.

It is obvious that various changes can be made in the above illustrated construction, within the spirit of my invention.

Having thus described my invention, what I claim is:—

1. In a machine of the class described, the combination of an expansible pulley, a collar on the shaft of said pulley, which collar is adapted, by movement along said shaft, to cause expansion or contraction of said pulley, a spring interposed between said collar and said pulley, and a rod connecting said collar with said pulley, whereby said spring may be put under tension.

2. In a machine of the class described, the combination of an expansible pulley, a collar on the shaft of said pulley, which collar is adapted, by movement along said shaft, to cause expansion or contraction of said pulley, a series of springs interposed between said collar and said pulley, and rods connecting said collar with said pulley, whereby said springs may be put under tension.

3. In a machine of the class described, the combination of a pulley adapted to be expanded or contracted by movement of two of its parts toward or from each other along the shaft, a screw shaft engaging one of said parts and passing freely through the other of such parts, a collar through which said shaft is threaded, springs interposed between said collar and the adjacent pulley part, and mechanism for rotating said screw shaft, which mechanism is adapted to be actuated by a movement parallel to said pulley shaft.

4. In a machine of the class described, the combination of an expansible pulley that is adapted to be expanded by movement of two of its parts along its shaft, a screw shaft for effecting said movement, a ratchet wheel for turning said screw shaft, and means for moving said ratchet wheel in opposite directions.

5. In a machine of the class described, the combination of an expansible pulley that is adapted to be expanded by movement of two of its parts along its shaft, a screw shaft for effecting said movement, a ratchet wheel for turning said screw shaft, and a double pawl for moving said ratchet wheel in opposite directions.

6. In a machine of the class described, the combination of an expansible pulley that is adapted to be expanded by movement of two of its parts along its shaft, a screw shaft for effecting said movement, a ratchet wheel for turning said screw shaft, a double pawl for moving said ratchet wheel in opposite directions, and a part movable along said pulley shaft for actuating said double pawl.

7. In a machine of the class described, the combination of an expansible pulley, a shaft for expanding and contracting said pulley, a ratchet wheel for rotating said expanding shaft, a pawl-carrier journaled concentric with said ratchet wheel, a double pawl carried by said pawl-carrier, means causing greater friction of said pawl-carrier on its journal than of said double pawl on its fulcrum, and means for operating said double pawl, said last-mentioned means being movable parallel to the pulley shaft.

8. In a machine of the class described, the combination of an expansible pulley, a shaft for expanding said pulley, a ratchet wheel for rotating said shaft, a pawl-carrier journaled concentric with said ratchet wheel, a spring offering resistance to the movement of said pawl-carrier, a double pawl fulcrumed on said pawl-carrier, and means movable parallel to the pulley shaft for operating said double pawl.

9. In a machine of the class described, the combination of an expansible pulley, a shaft for expanding said pulley, a ratchet wheel for rotating said shaft, a pawl-carrier journaled concentric with said ratchet wheel, a spring offering resistance to the movement of said pawl-carrier, a double pawl fulcrumed on said pawl-carrier, means movable parallel to the pulley shaft for operating said double pawl, and means for preventing engagement of the inactive pawl on the return movement of the active pawl.

10. In a machine of the class described, the combination of an expansible pulley, a shaft for expanding said pulley, a ratchet wheel for rotating said shaft, a pawl-carrier journaled concentric with said ratchet wheel, a spring offering resistance to the movement of said pawl-carrier, a double pawl fulcrumed on said pawl-carrier, means movable parallel to the pulley shaft for operating said double pawl, and means for preventing engagement of the inactive pawl on the return movement of the active pawl, said means consisting of a shield over which said inactive pawl travels during the forward movement of the active pawl.

11. In a machine of the class described, the combination of an expansible pulley, means for expanding and contracting said pulley, and means for operating said expanding and contracting means, said last mentioned means comprising a part movable along the pulley shaft, said part when in operation to expand the pulley making a series of reciprocations along the shaft, and means whereby when said series of reciprocations takes place along one

portion of the shaft, the pulley shall be expanded, and when it takes place along another portion of the shaft, the pulley shall be contracted.

12. In a machine of the class described, the combination of an expansible pulley, means for expanding said pulley, a collar movable along the shaft of the pulley, and connections between said collar and said means for expanding the pulley, and means whereby when the said collar is reciprocated within certain limits, the pulley shall be contracted, and when reciprocated within other limits the pulley shall be expanded.

13. In a machine of the class described, the combination of two expansible pulleys, belts passing around said pulleys, means for expanding and contracting said pulleys, said means being guided in a direction parallel to the pulley shafts, and means whereby reciprocations of the operating parts within certain limits along said shafts shall cause expanding of said pulleys, and similar movements within other limits along said shafts shall cause contraction of said pulleys.

14. In a machine of the class described, the combination of two expansible pulleys, belts passing around said pulleys, means for expanding and contracting said pulleys, said means being guided in a direction parallel to the pulley shafts, and means whereby reciprocations of the operating parts within certain limits along said shafts shall cause expanding of said pulleys, and similar movements within other limits along said shafts shall cause contraction of said pulleys, and means for causing movement of said operating parts within the desired limits, at will.

15. In a machine of the class described, the combination of two expansible pulleys, belts connecting said pulleys, means for expanding and contracting said pulleys, which means comprise ratchet wheels, double pawls for actuating said ratchet wheels in either direction, pawl-carriers on which said pawls are fulcrumed, said pawl-carriers being journaled concentric with said ratchet wheels, springs tending to resist movement of said pawl-carriers, parts movable longitudinally of said shafts for actuating said pawls, means for reciprocating said pawls on either side of the normal position of the pawl-carrier, at will, and means for preventing engagement of the inactive pawl with the ratchet wheel.

16. In a machine of the class described, the combination of two expansible pulleys, belts connecting said pulleys, means for expanding and contracting said pulleys, which means comprise ratchet wheels, double pawls for actuating said ratchet wheels in either direction, pawl-carriers on which said pawls are fulcrumed, said pawl-carriers being journaled concentric with said ratchet wheels, springs tending to resist movement of said pawl-carriers, parts movable longitudinally of said shafts for actuating said pawls, means for reciprocating said pawls on either side of the normal position of the pawl-carrier, at will, and means for preventing engagement of the inactive pawl with the ratchet wheel, said means for reciprocating said pawls comprising levers having stationary fulcrums, said levers having substantially parallel power arms, and means for adjustably connecting said power arms.

17. In a machine of the class described, the combination of two expansible pulleys, belts connecting said pulleys, means for expanding and contracting said pulleys, which means comprise ratchet wheels, double pawls for actuating said ratchet wheels in either direction, pawl-carriers on which said pawls are fulcrumed, said pawl-carriers being journaled concentric with said ratchet wheels, springs tending to resist movement of said pawl-carriers, parts movable longitudinally of said shafts for actuating said pawls, means for reciprocating said pawls on either side of the normal position of the pawl-carrier, at will, and means for preventing engagement of the inactive pawl with the ratchet wheel, said means for reciprocating said pawls comprising levers having stationary fulcrums, said levers having substantially parallel power arms, means for adjustably connecting said power arms, said means for adjustably connecting said power arms comprising parallel rods connected to said power arms, a bracket secured to one of said rods, a slide secured to the other of said rods, and means for locking said bracket and slide in different relative positions.

18. In a machine of the class described, the combination of two expansible pulleys, belts connecting said pulleys, means for expanding and contracting said pulleys, which means comprise ratchet wheels, double pawls for actuating said ratchet wheels in either direction, pawl-carriers on which said pawls are fulcrumed, said pawl-carriers being journaled concentric with said ratchet wheels, springs tending to resist movement of said pawl-carriers, parts movable longitudinally of said shafts for actuating said pawls, means for reciprocating said pawls on either side of the normal position of the pawl-carrier, at will, and means for preventing engagement of the inactive pawl with the ratchet wheel, said means for reciprocating said pawls comprising levers having stationary fulcrums, said levers having substantially parallel power arms, means for adjustably connecting said power arms, said means for adjustably connecting said power arms comprising parallel rods connected to said power arms, a bracket secured to one of said rods, a slide secured to the other of said rods, and means for locking said bracket and slide in different relative positions, said locking means comprising a latch carried by one of said parts and adapted to engage one or the other of several sockets carried by the other of said parts.

19. In a machine of the class described, the combination of two expansible pulleys, belts connecting said pulleys, means for expanding and contracting said pulleys, which means comprise ratchet wheels, double pawls for actuating said ratchet wheels in either direction, pawl-carriers on which said pawls are fulcrumed, said pawl-carriers being journaled concentric with said ratchet wheels, springs tending to resist movement of said pawl-carriers, parts movable longitudinally of said shafts for actuating said pawls, means for reciprocating said pawls on either side of the normal position of the pawl-carrier, at will, and means for preventing engagement of the inactive pawl with the ratchet wheel, said means for reciprocating said pawls comprising levers having stationary fulcrums, said levers having substantially parallel power arms, means for adjustably connecting said power arms, said means for adjustably connecting said power arms comprising parallel rods connected to said power arms, a bracket secured to one of said rods, a slide secured to the other of said rods, and means for locking said bracket and slide in different relative positions, said locking means comprising a latch carried by one of said parts and adapted to engage any one of several sockets carried by the other of said parts, and a lever engaging said bracket and slide for shifting them relative to each other.

20. In a machine of the class described, the combination of a pair of expansible pulleys, means for expanding and contracting them, comprising pawl and ratchet mechanism operable by movements parallel to the pulley shafts, said mechanism when operated within certain limits causing an expanding movement, and when operated within other limits causing a contracting movement, means for operating said pawl and ratchet mechanism, comprising a reciprocable rod, a controller cam carried by said rod, and a crank shaft, said controller cam being so constructed that when said crank shaft is rotated in one direction the cam will reciprocate within certain limits, and when said crank shaft is rotated in the opposite direction the controller cam will reciprocate within other limits.

21. In a machine of the class described, the combination of a pair of expansible pulleys, means for expanding and contracting them, comprising pawl and ratchet mechanism operable by movements parallel to the pulley shafts, said mechanism when operated within certain limits causing an expanding movement, and when operated within other limits causing a contracting movement, means for operating said pawl and ratchet mechanism, comprising a reciprocable rod, a controller cam carried by said rod, and a crank shaft, said controller cam having a projection perpendicular to said rod, which projection is short enough so that it does not intercept movement of the crank pin on one side of the center, and said cam having surfaces on opposite sides of said projection for engagement with said crank pin.

22. In a machine of the class described, the combination of a pair of expansible pulleys, means for expanding and contracting them, comprising pawl and ratchet mechanism

operable by movements parallel to the pulley shafts, said mechanism when operated within certain limits causing an expanding movement, and when operated within other limits causing a contracting movement, means for operating said pawl and ratchet mechanism, comprising a reciprocable rod, a controller cam carried by said rod, and a crank shaft, said controller cam having a projection perpendicular to said rod, which projection is short enough so that it does not intercept movement of the crank pin on one side of the center, and said cam having surfaces on opposite sides of said projection for engagement with said crank pin, and a lever that is adapted to be swung by said crank pin and having a slot engaging a pin on said controller cam.

In testimony that I claim the foregoing I have hereunto set my hand.

HOWARD ROY STACKS.

Witnesses:
JOSEPH M. HEWLETT,
JAMES E. SAVACOOL.