

No. 807,682.

PATENTED DEC. 19, 1905.

T. S. MILLER.

ROPE DRUM.

APPLICATION FILED OCT. 30, 1903.

4 SHEETS—SHEET 1.

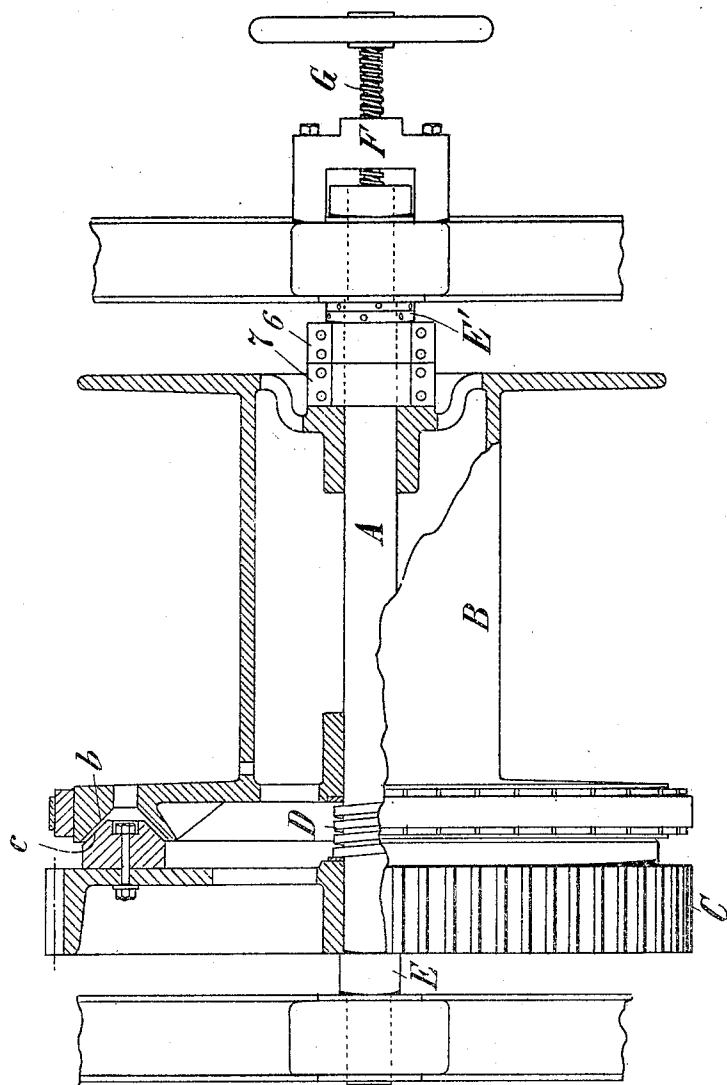


Fig. 1.

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4 SHEETS—SHEET 2.

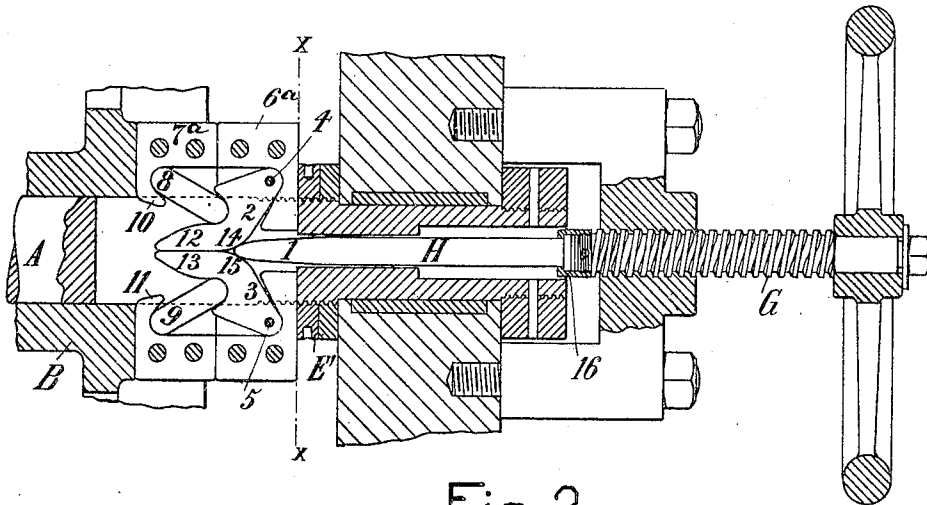


Fig. 2.

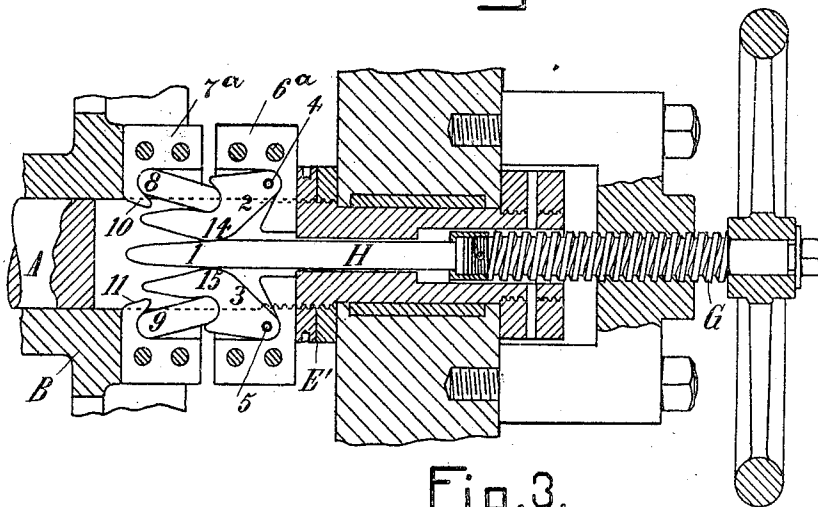


Fig. 3.

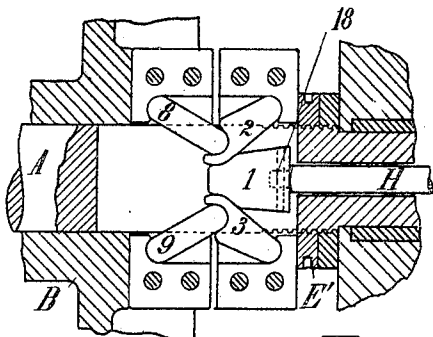


Fig. 5.

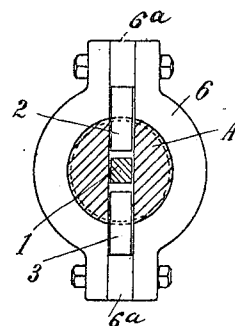


Fig. 4.

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4 SHEETS—SHEET 3.

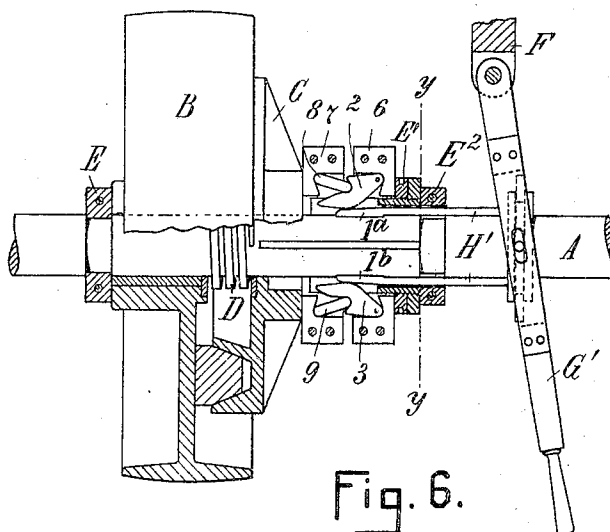


Fig. 6.

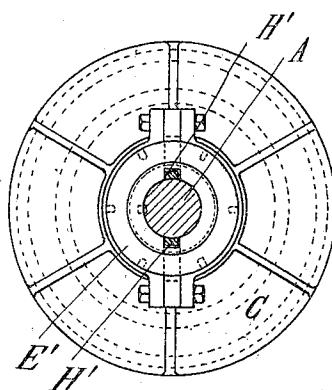


Fig. 7.

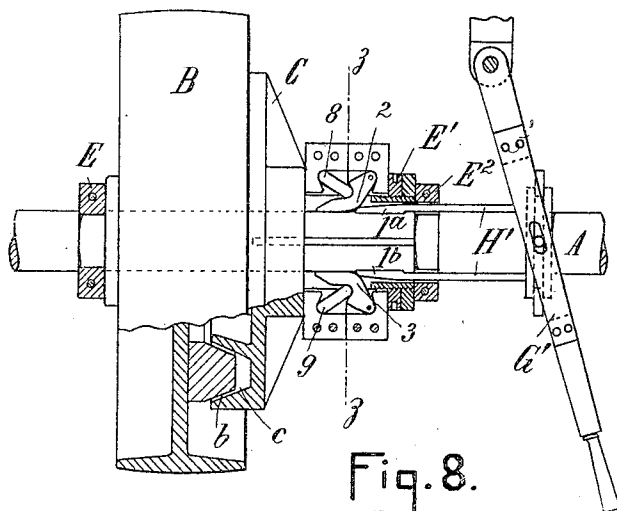


Fig. 8.

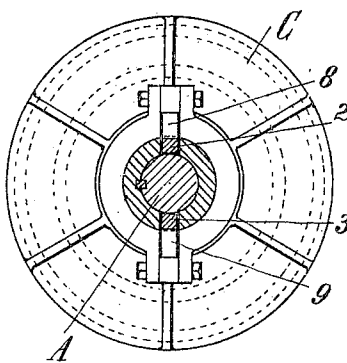


Fig. 9.

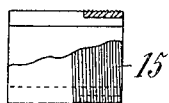


Fig. 10.

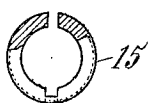


Fig. 11.

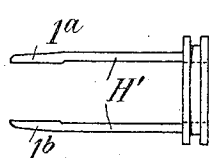


Fig. 12.

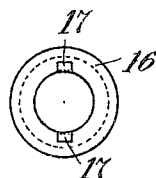


Fig. 13.

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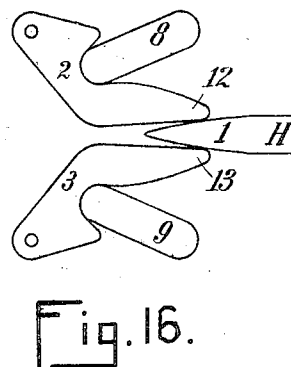
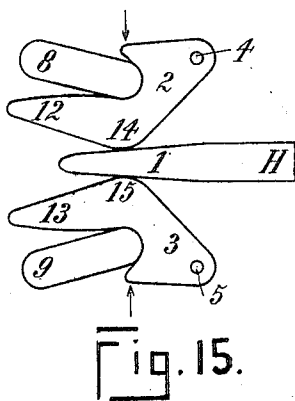
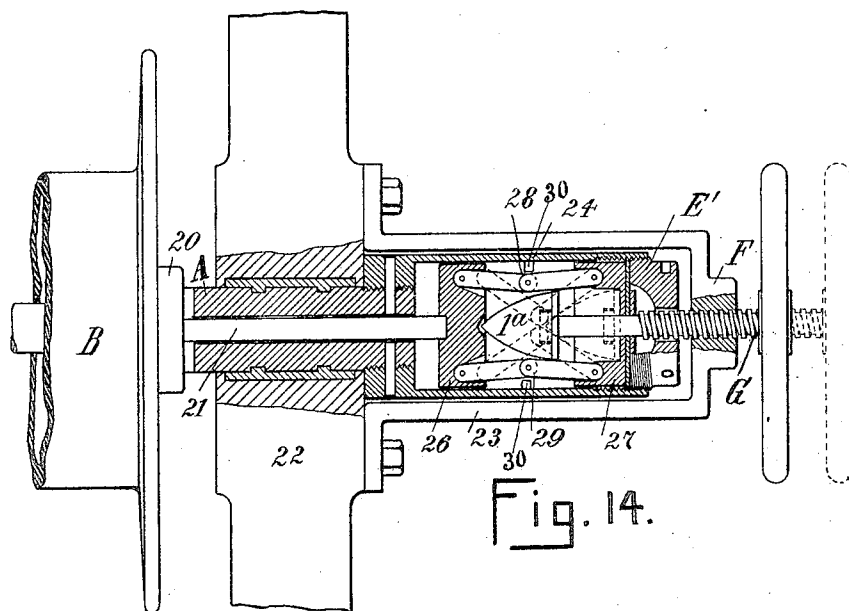
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

THOMAS SPENCER MILLER, OF SOUTH ORANGE, NEW JERSEY.

ROPE-DRUM.

No. 807,682.

Specification of Letters Patent.

Patented Dec. 19, 1905.

Application filed October 30, 1903. Serial No. 179,121.

To all whom it may concern:

Be it known that I, THOMAS SPENCER MILLER, a citizen of the United States, and a resident of South Orange, county of Essex, and State of New Jersey, have invented a new and useful Improvement Applicable to Rope-Drums, of which the following is a specification.

Heretofore a thrusting device having stationary bearings (such as a screw or a shifting-lever) has been employed for imparting to a clutch member mounted upon a rotating shaft the longitudinal thrust necessary for setting the clutch, and various forms of mechanism have been employed on or in the rotating shaft for communicating the thrust of the said screw or shifting-lever to the clutch member. Some of these mechanisms were non-self-locking, it being necessary to continue the pressure of the screw or shifting-lever for the purpose of holding the clutch in set position. Such a device had the advantage of variability of clutching pressure combined with the disadvantages of non-self-locking, loss of power, and development of heat at the point where the clutch-setting power was communicated between the non-rotating and rotating parts. Other of these mechanisms embodied a positive self-locking at the passing of a point or center, so that when the clutch was set the pressure of the screw or lever might be discontinued without permitting the clutch to unset itself; but combined with this self-locking advantage this mechanism contained the disadvantage of non-variability of pressure during operation when set and locked. In other words, as soon as the clutch was set and locked the operator was powerless to increase the pressure of the clutch member during operation by the further movement of the screw or shifting-lever.

One part of my present invention is to combine in one construction the advantages above referred to without the disadvantages. This I accomplish by a mechanism possessing the capacity of substantial self-locking in a plurality of positions, so that it is within the power of the operator of the screw or shifting-lever to move the clutch member through a wide range of pressures at any of which the rotating clutch-setting mechanism will substantially self-lock, so that the operator has it within his power by the movement of the screw or shifting-lever to produce any desired degree of pressure between the clutch members, and at the same time to permit the

clutch to run at any of said degrees of pressure without continuing the full force of the thrust of the screw or hand-lever against the rotating mechanism. In carrying out this part of my invention I employ between the shifting-lever or screw and clutch member what may properly be termed a "friction" locking device or mechanism, or, in other words, one in which the lock is produced by the substantial preponderance of friction between the parts over the resultant of force tending to move said parts backward, so that the friction between the surfaces at any point throughout a range of movement is sufficient to substantially lock the surfaces against such backward movement as would permit the clutch to unset itself. I do not, however, limit myself to said friction-lock feature, other features of my invention being set forth in the following description and claims.

In the accompanying drawings I have shown several forms in which my invention may be embodied, but variations thereof are of course possible without departing from the principles of my invention.

Figure 1 is a rope-drum mechanism, partly in section, containing my invention. Figs. 2 and 3 are longitudinal sectional details of the same, corresponding, respectively, with the unset and maximum set positions of the clutch, all degrees of friction-locked set positions being possible between said extremes. Fig. 4 is a cross-sectional detail on the line $x x$ of Fig. 2. Fig. 5 is a longitudinal sectional detail of a modification. Fig. 6 is a clutch-pulley in maximum set position and partly in section, with my invention applied. Fig. 7 is a cross-section of the same on the line $y y$ of Fig. 6. Fig. 8 is the same, partly in longitudinal section, in unset position. Fig. 9 is a cross-section of the same on the line $z z$ of Fig. 8. Figs. 10, 11, 12, and 13 are detached parts of the construction shown in Figs. 6 to 9, inclusive. Fig. 14 is a modification adapted for attachment to friction-drums of old construction. Fig. 15 is a diagram to explain the direction of forces. Fig. 16 shows the wedge operating the toggles from the reverse direction.

In all of the figures A is a rotating shaft. B is a clutch member revolubly mounted on the shaft and containing the friction clutch-surface b . C is a clutch member revolubly fixed on the shaft, containing the friction clutch-surface c . A relative longitudinal movement on the shaft between the clutch

members B and C is permitted and the two are normally held apart by the interposed coiled spring D. E and E' are abutments fixed to the shaft, between which the clutch members are mounted and which serve to relieve the bearings of the shaft from the end thrust necessary for setting the clutch. E' is made longitudinally adjustable on the shaft, so that the distance between the abutments may be varied. F is the fixed bearing for the hand-operated screw G or lever G', by the movement of which the operator determines the setting or unsetting of the friction clutch-surfaces. H is a member carried by and rotating with the shaft, which receives the thrust of the screw G on one side of the abutment E' and transmits it to, through, and beyond said abutment. H' performs the corresponding function for the hand-lever G'.

Heretofore in cases where it was possible for the operator by the continued forward movement of the screw G or lever G' to produce any considerable variation of pressure between the clutching-surfaces it has been necessary after moving the clutch-surface up to the requisite pressure to hold it there by continuing the full force of pressure of the screw G or lever G' against the rotating member H or H', or, in other words, by continuing the full setting pressure between relatively non-rotating and rotating surfaces. This has been the cause of loss of power and generation of such an intense heat between the relatively non-rotating and rotating surfaces as to in many instances destroy the same notwithstanding many remedies that have been attempted. The problem of overcoming this difficulty while retaining the advantages of a variable pressure between the clutching-surfaces while in operation may be solved by the following mechanism, which I will first describe in connection with Figs. 2 and 3: On the forward end of the member H is formed or secured a wedge 1, interposed between the links 2 and 3, articulated, respectively, at 4 and 5 on a collar 6, which is carried by the shaft and rests against the abutment E'. A collar 7, carried by the shaft, rests against the longitudinally-movable clutch member, as B.

A link 8 forms with the link 2 a toggle between the collars 6 and 7 on one side of the shaft-axis, and a link 9 forms with the link 3 a toggle on the opposite side. Projections 10 and 11 from the plates 6^a and 7^a, clamped between the ears of each collar, serve to keep the links 8 and 9 in place. The inner edges of said plates also serve as stops to prevent the toggles from reaching a straight or positively-locking position. The shaft is slotted, as shown in Fig. 4, to receive the wedge 1 and the toggles, which open inwardly toward the center of the shaft. The links 2 and 3 are provided with toes 12 and 13, the soles of which rest together in the position shown in Fig. 2, where the wedge 1 is withdrawn and

the toggles are entirely open and the collars 6 and 7 are in contact and the clutch is fully unset. The heels 14 and 15 of the links 2 and 3 are rounded to ease the entrance of the wedge 1 between them. The projection constituting these toes and heels forms covers of the joints or knuckles between the toggle-links. A pulling connection 16 is provided between screw G and pin H. The mode of the operation may be explained by reference to the diagram of Fig. 15, wherein the wedge is shown as about half-way inserted. The reaction of the friction clutch-surfaces tending to open the toggles produces pressure by them against the wedge in the direction of the arrows. The inclined surfaces of the wedge are so nearly at right angles with the direction of this pressure, however, that the pressure is powerless to overcome the friction between the wedge and the toggles and is thus powerless to shove the wedge backward on whatever part of the wedge the toggles may rest. Therefore when the operator has shoved the wedge forward to the position, for example, shown in Fig. 15 he may reduce or relieve the pressure of the screw G or lever G' and the friction of the wedge will substantially lock the parts against backward movement. If then the operator desires to increase the pressure of the clutch-surfaces, he may force the wedge farther forward, or if he wishes to decrease the same he may draw the wedge farther backward, and still at whatever degree of pressure he places the clutch-surfaces the friction of the wedge will substantially lock or assist in locking the parts against backward movement from that position. Therefore while the clutch is running the operator may change the pressure of the clutch-surfaces through a range depending only upon the length of the wedge and still may permit the clutch to run at any point within this range of pressure with the pressure between the non-rotating part G and rotating part H reduced to any desired extent, and consequently without either undue loss of power or generation of heat between those parts. The angle or degree of evolution of the inclined surfaces of the wedge from the axis of the shaft which I employ in practice is less than the angle of repose, which angle of repose will of course vary, depending on whether the surfaces are smooth and of high coefficient of friction and highly lubricated or are rough or corrugated or of low coefficient of friction or unlubricated. Under certain conditions an angle as great as from ten to fifteen degrees might produce a complete friction-lock, while under others an angle as low as three degrees would be used.

In the construction shown in Figs. 6 to 13, inclusive, the collars 6 and 7 and toggles 2 8 and 3 9 are substantially the same as before, but the wedge is divided into two parts 1^a and 1^b, which rest against the outside of the shaft. The toggles when open likewise rest against

the outside of the shaft. In this form of construction no recess need be formed in the shaft, which is surrounded by the collar 15, suitably recessed to admit the toggles and the wedges 1^a and 1^b and screw-threaded to receive the abutment E'. It is prevented from backward movement along the shaft by the supplemental abutment E', through openings in which the member H' extends.

The construction shown in Fig. 5 resembles that shown in Figs. 2 and 3, excepting that the wedge 1 forms a swivel connection at 18 with the member H, also that the wedge and the links 2 3 are of somewhat different form shown.

In Fig. 14 the maximum set and unset positions are shown, respectively, in full and dotted lines. B is the ordinary friction rope-drum. 20 is the ordinary cross-key extending through the shaft and resting outside of the shaft against the rope-drum and forced forward by the ordinary central pin 21. 22 is the stationary frame carrying the end bearings for shaft A. 23 is a yoke bolted to the face of the frame 21 and carrying the nut F, in which the operating-screw G is threaded. 24 is a shell or case fixed on the end of the shaft 3 and to which is adjustably screw-threaded the abutment E'. 26 and 27 are two heads longitudinally movable in the case 24, the forward side of one of which abuts against the end of the pin 21 and the backward side of the other of which abuts against the abutment E'. Interposed between the heads 26 and 27 are the two toggles 28 and 29 opening inwardly toward each other and spread apart by the wedge 1^a, swiveled to the end of the operating-screw G, which swivel constitutes the point of contact between the non-rotating and rotating parts. In this case the angle of the wedge-surface is shown as decreasing from front to rear, for the reason that the more obtuse angle of front part of the wedge will force the clutch-surfaces toward each other till they are brought in contact, whereupon the more acute angle toward the rear of the wedge will come in play to vary the pressure of the clutch-surfaces against each other through the desired range, while forming a friction-lock at any point of that range. 30 represents stops to prevent the toggles from forming a positive lock.

As to the surface productive of the friction-lock, I do not limit myself to the form of surface shown or to the embodiment of it in a wedge or to the movement of it parallel with the axis of the shaft or in a straight line. As to the elements—i. e., toggle or equivalent and wedge or equivalent—which constitute the mechanism rotating with the shaft, whereby the power delivered by the prime mover G or G' is multiplied, I do not limit myself to them either in number, kind, or arrangement. Nevertheless by constructing the du-

plex power-multiplying friction-locking mechanism of the toggle and wedge with a friction-lock interaction and placing said mechanism forward of the point where the contact occurs between the non-rotating and rotating parts exceedingly good results are accomplished, since not merely the friction-lock, but also the multiplication of power, may occur forward of said point of contact.

Some of the features, severally or in combination, referred to in one or more of the claims may be pointed out as follows: It will be observed that in each of the constructions shown the power-multiplying mechanism is retained by a holder or case. In Figs. 1 to 9 this is composed of the sectional rings 6 7 and plate 6^a and 7^a, while in Fig. 14 it is composed of the shell 24. In each form this holder is mounted upon the outside of the shaft, being screwed on the outside of the end of the shaft in Fig. 14 and in Figs. 1 to 9 being held around the shaft by the bolting of its sections together. In each form shown this holder circumferentially binds together the opposite members of the two toggles. The abutment E' is in all forms substantially outside the shaft. In Fig. 14 it is connected with the shaft by the holder 24, whereas in Figs. 1 to 9 the abutment is mounted directly on the outside of the shaft. In all the forms shown there is a screw-threaded adjustment between the abutment and the shaft. In all forms the power from the actuator is transmitted past the abutment by extending the mechanism inside the abutment. In all forms the clutch-setting mechanism is located substantially on that portion of the shaft protruding from the drum, so that it requires no special construction of drum substantially different from those heretofore used. In Figs. 1 to 5 it is located on that portion of the shaft between the drum and its bearing and in Fig. 14 on the outside of the bearing.

The oppositely-disposed power devices (which I have shown in the form of toggles) and the spreader therefor (which I have shown in the form of a wedge) are herein shown with the spreader extending across the line of the shaft in a position either within the shaft itself, as in Figs. 2, 3, 4, and 5, or opposite the end of the shaft, as in Fig. 14, the latter arrangement being also shown in my application, Serial No. 147,937, originally filed March 16, 1903. Claims are contained herein intended to cover generically combinations containing the spreader in either of said positions, while other claims are contained herein intended to cover combinations containing the spreader specifically in the position shown in said Figs. 2, 3, 4, and 5, leaving the claims for combinations containing the spreader specifically in the position shown in said Fig. 14 to said application filed March 16, 1903.

In the examples above given of my inven-

tion the speed of rotation is supposed to be insufficient to develop sufficient centrifugal force in the parts to require counterbalancing.

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

1. A clutch set by its longitudinal movement, in combination, with an operating member, a non-rotating support therefor and a rotating clutch-setting mechanism containing a
10 power-multiplying device operated by the sliding engagement of an incline which is disposed within the angle of repose and extends beyond the normal limit of throw permitted by the clutch.

15 2. In combination, a clutch, a rotating shaft, an actuator at the end of the shaft, a non-rotating support therefor, and the following mechanism rotating with the shaft, viz: an abutment outside the shaft, a power device
20 bearing directly against said abutment whereby the clutch is set, and a spreader extending across the line of said shaft and radially operating said power device.

3. In combination, a clutch, a rotating shaft,
25 an actuator at the end of the shaft, a non-rotating support therefor, and the following mechanism rotating with the shaft, viz: an abutment outside the shaft, a power device bearing directly against said abutment where-
30 by the clutch is set, a spreader extending across the line of said shaft and radially operating said power device and a thrust-pin extending into said shaft past one of the bearings thereof.

4. A clutch set by its longitudinal move-
35 ment, in combination with a relatively non-rotating operating member and a rotating clutch-setting mechanism containing a power-multiplying device operated by an incline so disposed that the maximum locking of said
40 clutch in normal running is produced by friction with said incline.

5. A clutch set by its longitudinal movement, in combination with a clutch-setting mechanism containing a toggle operated by the
45 sliding engagement of an incline.

6. A clutch set by longitudinal movement, in combination with a clutch-setting mechanism containing a toggle operated by a recip-
50 roating wedge.

7. A clutch, in combination with a relatively non-rotating operating member and a rotating clutch-setting mechanism containing an inclined member mounted to reciprocate and a power-multiplying device forming a friction
55 locking engagement with said incline at a point between its extremes when said clutch is in normally set position.

8. In combination, a rotating shaft, a clutch, a relatively non-rotating operating member
60 and a rotating clutch-setting mechanism containing an inclined member mounted to reciprocate parallel with the shaft and a power-multiplying device forming a friction locking engagement with said incline at a point be-

tween its extremes when said clutch is in nor- 65
mally set position.

9. A rotating shaft and a clutch set by longitudinal movement thereon, in combination with a clutch-setting mechanism containing a friction locking device carried within a recess 70
of the shaft.

10. In combination, a revolving shaft, a clutch member longitudinally movable thereon, an abutment thereon, a thrust device interposed between said abutment and clutch 75
member and a friction locking member rotating with said shaft.

11. In combination, a revolving shaft, a clutch member longitudinally movable thereon, an abutment, a thrust device interposed 80
between said abutment and clutch member, a friction locking member rotating with said shaft, a connecting member extending from said locking member through and beyond said abutment and an operating member having 85
stationary bearings.

12. A rotating shaft and a clutch thereon, in combination with a relatively non-rotating operating member and a clutch-setting mechanism containing a friction locking device 90
carried within a recess of the shaft.

13. A rotating shaft and a clutch thereon, in combination with a relatively non-rotating operating member, an inclined member carried within a recess of the shaft and a power- 95
multiplying device forming a friction locking engagement with said inclined member.

14. A rotating shaft and a clutch thereon, in combination with a relatively non-rotating operating member, a pin extending from the end of said shaft to a recess therein a friction locking member operated by said pin within said recess and a power-multiplying device forming a friction-lock with said friction locking member. 100
105

15. A rotating shaft, a clutch thereon, in combination with a relatively non-rotating operating member, a collar fixed to the shaft, a power-multiplying device bearing upon said collar and a device carried within a recess of 110
the shaft and forming a friction locking engagement with said power-multiplying device.

16. A clutch set by its longitudinal movement, in combination with a non-rotating operating member and a clutch-setting mechanism containing a toggle operated by the sliding engagement of an incline, which incline is in turn operated by a pin concentric with the shaft. 115

17. A rotating shaft, its bearings, a clutch 120
set by longitudinal movement thereon, and a relatively non-rotating actuator in combination with the following parts extending within the shaft, viz: a pin whereby the thrust is transmitted through one of the shaft-bearings 125
to a power-multiplying mechanism consisting of a pair of toggles normally disposed with the knuckles nearer the axis of the shaft than

their extremities, and means whereby the knuckle of each toggle is thrust radially outward.

18. A rotating shaft, a clutch thereon, an operating member and a non-rotating support therefor, in combination with a clutch-setting mechanism containing power - multiplying mechanism extending within the line of said shaft, and an abutment therefor adjustably secured to said shaft by a screw-threaded connection on the periphery thereof.

19. In combination, a rotating shaft, its bearings, a gear fixed on said shaft, a rope-drum movable thereon, a friction-clutch between said gear and drum, two collars, one longitudinally fixed and the other movable on the shaft at the opposite end of said drum, a power-multiplying spreader between said collars and a pin for operating said spreader extending into said shaft through one of the shaft-bearings.

20. In combination, a rotating shaft, its bearings, a gear fixed on said shaft, a rope-drum movable thereon, a friction-clutch between said gear and drum, two collars, one longitudinally fixed and the other movable on the shaft at the opposite end of said drum, a wedging-spreader between said collars and a pin for operating said spreader extending within said shaft through one of the shaft-bearings.

21. In combination, a rotating shaft, its bearings, a gear fixed on said shaft, a rope-drum movable thereon, a friction-clutch between said gear and drum, two collars, one longitudinally fixed and the other movable on the shaft at the opposite end of said drum, a power-multiplying spreader between said collars, a wedge for operating said spreader and a member for operating the wedge extending through one of said collars.

22. In combination, a rotating shaft, a clutch member secured thereto, a rope-drum loosely mounted thereon, friction-surfaces between said clutch member and said drum, a collar adjacent to said drum free to move longitudinally on said shaft, an abutment on said shaft, power-multiplying mechanism partially or wholly contained in a slot in said shaft between said abutment and said collar, a pin for operating said power-multiplying mechanism having a longitudinal movement in said shaft, and means for thrusting said pin whereby the rope-drum may be forced against said clutch member.

23. In combination, a thrusting mechanism for operating a clutch by longitudinal movement of one of the members consisting of a pair of toggles; the ends of said toggles being at the same distance from the center of a shaft, and means for forcing said toggles outwardly and engaging with the knuckles of said toggles.

24. In combination a rotating shaft, clutch members mounted thereon, a slot in said shaft,

a pair of toggles whose knuckles extend within said slot, a pin for thrusting said toggles apart acting upon the knuckles of said toggles whereby by the thrusting of said pin in one direction the knuckles are forced apart and the clutch members pushed together.

25. In combination a rotating shaft, clutch members mounted thereon, a toggle whose knuckle extends toward the center of said shaft, a pusher-bar sliding along said shaft in contact with said knuckle whereby said toggle is straightened and the force of said toggle is transmitted to said clutch member.

26. In combination, a clutch set by longitudinal movement, a toggle for setting the same and means adjacent to the knuckle of said toggle for operating the same, one of the toggle-links containing a projection covering said knuckle.

27. In combination with a clutch, a shaft and a relatively non-rotating actuator, a rotating clutch-setting mechanism containing a pivotal member, a reciprocating member forming a friction-lock therewith and means of adjustment independent of said actuator; said friction-lock extending beyond the normally set position of the clutch and being disposed within the angle of repose.

28. In combination, a rotary shaft, a rope-drum revoluble thereon, clutch members secured respectively to said shaft and said drum, an actuator located at the end of the shaft and the following mechanism mounted upon the shaft between the actuator and drum and rotating with the shaft, viz: an abutment, a power device bearing against said abutment whereby the clutch is set, a spreader extending across the line of said shaft and radially operating said power device and an operative connection extending inside said abutment.

29. In combination, a rotating shaft, its bearings, a rope-drum revoluble on said shaft, clutch members secured respectively to said shaft and said drum, an actuator located at the end of said shaft, a non-rotating support therefor, a thrust-pin extending from said actuator through one bearing of the shaft and the following mechanism mounted upon the shaft between its bearing and said rope-drum, viz: an abutment, a power device bearing against said abutment whereby the clutch is set and a spreader extending across the line of said shaft and radially operating said power device.

30. In combination, a clutch, a shaft, power-multiplying clutch - setting mechanism, a holder surrounding the same, an actuator and a connection extending within the shaft from said actuator to said clutch-setting mechanism.

31. In combination, a clutch, a shaft, two oppositely-disposed power mechanisms rotating with the shaft for setting said clutch, a circumferential holder connecting opposite members of said mechanisms, an actuator located at the end of the shaft, a non-rotating

support therefor, a spreading mechanism located in a recess of said shaft and a connection between said spreading mechanism and said actuator extending within said shaft from the end thereof to said recess.

32. In combination, a clutch, a shaft, two oppositely-disposed power mechanisms, rotating with the shaft for setting said clutch, a holder therefor mounted on said shaft, an actuator, a non-rotating support therefor and a spreading mechanism located within said holder and in the line of said shaft through which said actuator operates said power mechanisms.

33. In combination, a clutch, a shaft, a power-multiplying clutch-setting mechanism rotating with the shaft, a holder and an abutment for the same, a member extending within the line of said shaft whereby said mechanism is operated, an actuator, a non-rotating support therefor and a connection whereby the power is transmitted past said abutment.

34. In combination, a clutch, a shaft, an abutment, a power-multiplying mechanism located between the abutment and clutch, an actuator and a non-rotating support therefor located on the opposite side of the abutment, an operative connection extending within said abutment and a device extending within the line of the shaft whereby said mechanism is operated.

35. In combination, a clutch, a shaft provided with a transverse slot and longitudinal hole, a pin in said hole, a spreader in said slot and a toggle cooperating therewith said spreader operating radially upon the knuckle of said toggle.

36. In combination, a clutch, a shaft provided with a transverse slot, and longitudinal hole, a pin in said hole, a spreader in said slot and a toggle the extremities of which are outside the shaft but the knuckle of which moves within said slot said spreader operating radially upon the knuckle of said toggle.

37. In combination, a clutch, a shaft provided with a transverse slot and longitudinal hole, a pin in said hole, a spreader in said slot, two toggles cooperating with said spreader and a holder extending around both of said toggles.

38. In combination, a friction rope-drum, shaft-bearings, a shaft having a transverse slot between the drum and one bearing and

a longitudinal hole extending past said bearing, a pin in said hole, an abutment on the shaft between said drum and bearing and a power-multiplying mechanism extending from said pin through said slot to the drum.

39. In combination, a shaft, a two-part holder mounted upon the shaft, means whereby one part thereof is stayed from longitudinal movement on the shaft, a clutch member set by the longitudinal movement of said other part, a mechanism mounted in said holder and operating to separate the two parts thereof, an actuator at the end of the shaft and a connection extending from the actuator within the shaft to said mechanism.

40. In combination, a clutch, a shaft, two collars by the separation of which the clutch is set, a shaft extending through said collars and having a transverse hole between them and a longitudinal hole thence to its end, and mechanism extending through said holes whereby said collars are separated.

41. In combination, a friction rope-drum, its shaft, a rotating holder secured to the shaft outside the drum, a clutch-setting mechanism held by said holder, a spreader within said holder whereby said mechanism is operated, an actuator, and a non-rotating support therefor.

42. In combination, a friction-drum, its shaft, a rotating holder secured to the shaft outside the drum, a clutch-setting mechanism held by said holder, a spreader within said holder whereby said mechanism is operated, a thrust-pin and an actuator.

43. In combination, a clutch, a shaft, an actuator, a thrust-pin in the shaft, two oppositely-disposed clutch-setting mechanisms, a holder therefor and a spreader in the line of the shaft between the same.

44. In combination, a clutch, a shaft, a longitudinally-moving thrust-pin and an actuator-pin carried respectively by the shaft and by a stationary support and a power-multiplying clutch-setting mechanism rotating with the shaft.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

THOMAS SPENCER MILLER.

Witnesses:

PRIOR SINCLAIR,

CHARLES G. MUNIER.