July 19, 1932. J. H. STALEY 1,868,262

FRICTIONAL RESISTANCE DEVICE

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Fig. 1.

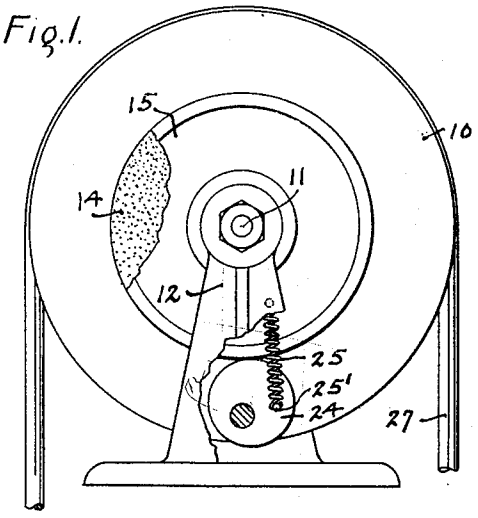
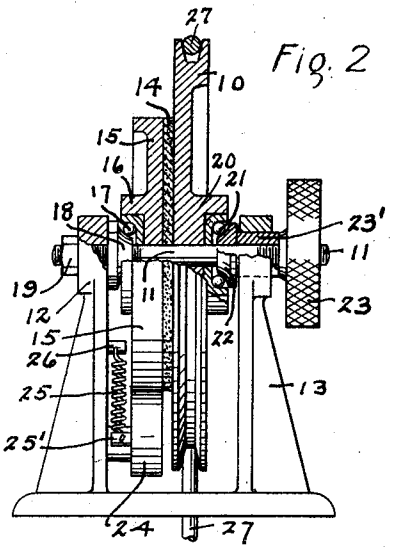


Fig. 2



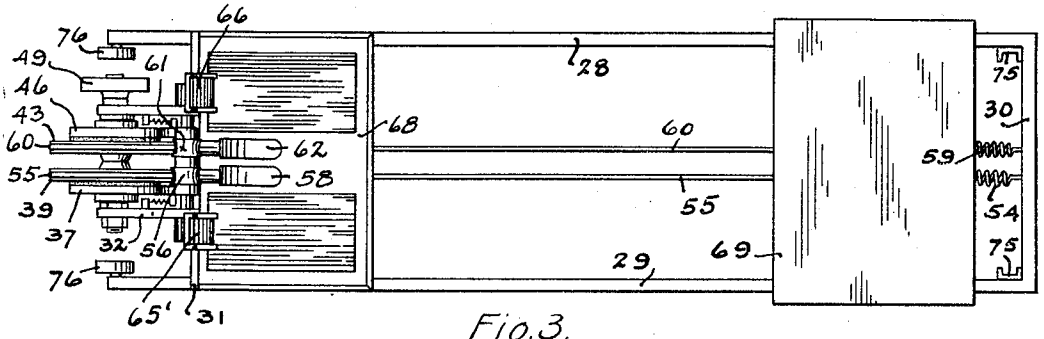


Fig. 3.

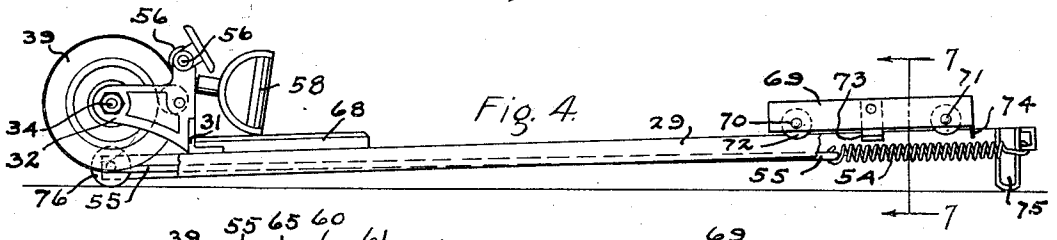


Fig. 4.

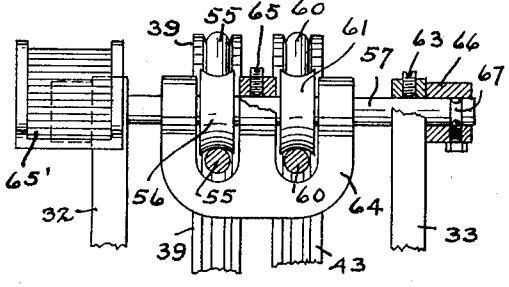


Fig. 6.

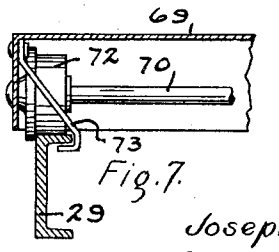


Fig. 7.

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Fig. 5.

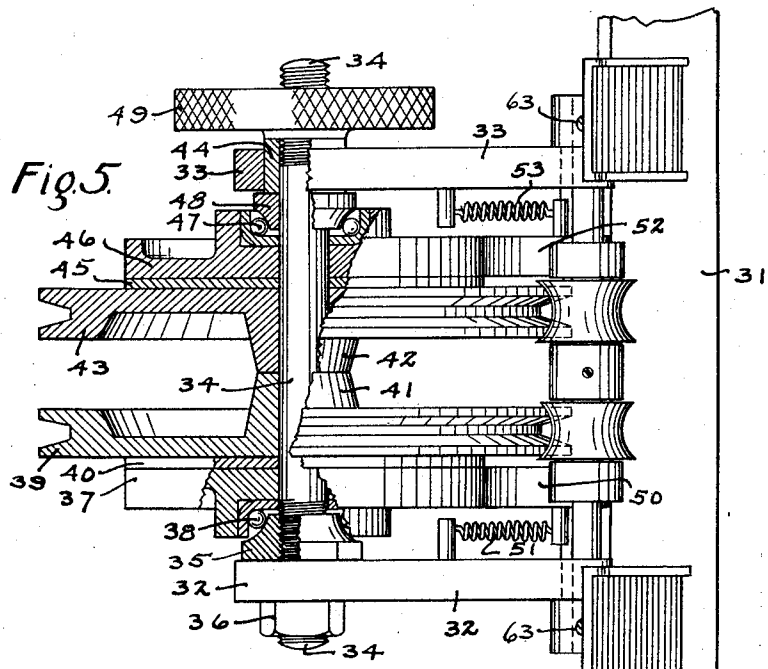
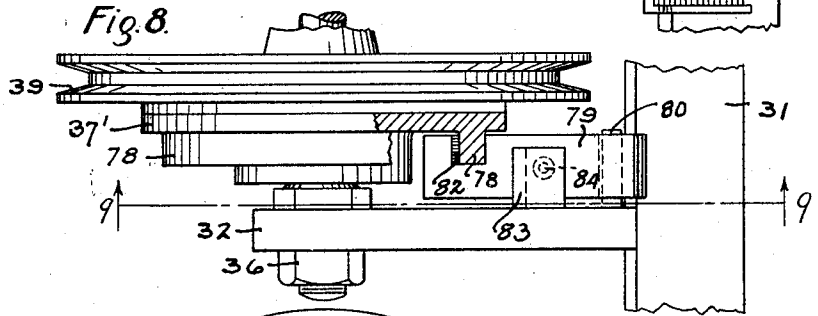


Fig. 8.



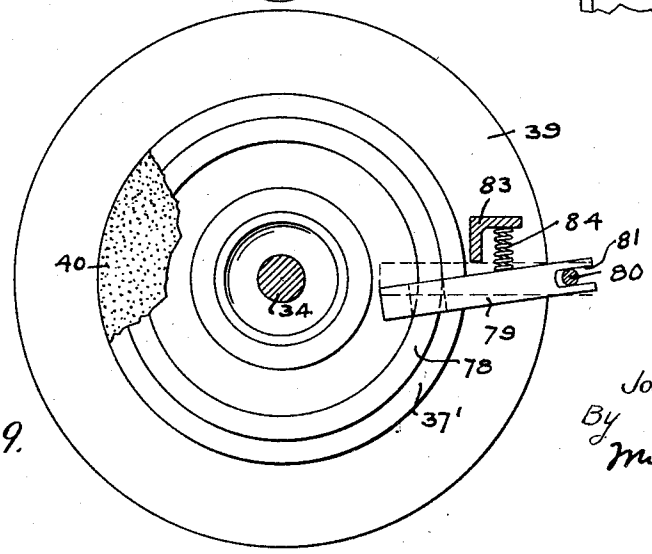


Fig. 9.

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UNITED STATES PATENT OFFICE

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FRICTIONAL RESISTANCE DEVICE

Application filed January 16, 1931. Serial No. 509,090.

This invention relates to the art of friction controlling devices and particularly to a mechanism permitting the free travel of a member in one direction but frictionally resisting under selective pressure the reverse travel of the member.

It is a primary object of my invention to provide a simple mechanism of the type indicated which may be readily adjusted by hand.

Another primary object of the invention resides in the application thereof to an exercising mechanism whereby a variable pull may be obtained against a pull by the same springs without the necessity of having to substitute one for the other, springs of varying sizes.

Further objects reside in the unique assembly and new association of the various elements entering into the combinations, such objects becoming apparent in the following description of the invention as illustrated by the accompanying drawings, in which

Fig. 1 is a fragmentary side elevation of a structure embodying my invention;

Fig. 2, an end elevation of the structure;

Fig. 3, a top plan view of an exercising device embodying my invention;

Fig. 4, a fragmentary side elevation of that device;

Fig. 5, a fragmentary top plan view on an enlarged scale of the friction device as shown in Fig. 3;

Fig. 6, a detail in fragmentary rear elevation of the rope guide and pedal mounting;

Fig. 7, a detail in vertical section on the line 7—7 in Fig. 4;

Fig. 8, a top plan view of a modified form of the friction plate holding mechanism; and

Fig. 9, a vertical section on the line 9—9 in Fig. 8.

Like characters of reference indicate like parts throughout the several views in the drawings.

Referring to the drawings, Figs. 1 and 2, wherein an elementary form of the invention is illustrated, a pulley 10 is rotatably carried on a shaft 11 which is carried by the brackets 12 and 13. A disc 14 made of any suitable material is loosely mounted on the shaft 11 and is adapted to be pressed laterally against the side face of the pulley 10 by means of a plate 15 also rotatably carried on the shaft 11. The plate 15 is provided with an outturned hub 16 within which are carried ball bearings 17 which may ride about the cone 18. The end of the shaft 11 is screw-threaded to screw-threadedly carry thereon the cone 18 and the nut 19 whereby the shaft 11 may be held stationary in respect to the bracket 12 by drawing up the nut 19 on the outer side of the bracket to carry the cone 18 firmly against the inner side of the bracket.

On the face of the pulley 10 directed toward the bracket 13 is the hub 20 within which are carried ball bearings 21 to ride about the cone 22 which is slidably carried on the shaft 11. The shaft 11 projects outwardly beyond the bracket 13 with a screw-threaded end on which is carried the adjusting wheel 23. A sleeve 23′ is slidably carried by the bracket 13 to receive the shaft 11 slidably therethrough. The sleeve is longer than the thickness of the bracket and when the wheel 23 is drawn up against the sleeve, the sleeve is pressed by its other end against the cone 22. A cam 24 is pivotally supported from the bracket 12 to have its contour in rotative contact with the periphery of the plate 15. A tension spring 25 has one end engaged to a post 26 on the bracket 12 and the other end to the post 25′ projecting laterally from the cam 24. By means of the spring 25, the cam 24 is rocked and held in contact with the plate 15.

The arrangement of the various parts above described is such that when the wheel 23 is allowed to remain loosely upon the shaft 11 without compressive contact against the sleeve 23′, the pulley 10 may be revolved freely about the shaft 11 in either direction, by any means such as the belt or rope 27. However, when the wheel 23 is turned about the shaft 11 to compressively contact the sleeve 23′, the sleeve 23′ is pressed against the cone 22 sufficiently to cause the pulley 10 and plate 15 with the intervening friction facing 14 to be drawn into intimate contact one with the other by compression against the cone 18 with the result that as the pulley

10 may be revolved, the plate 15 will also revolve therewith unless it be held to permit a slipping action between the pulley 10, the facing 14, and the plate. The degree of such slippage is determined by the adjustment of the wheel 23, tightening it against the sleeve 23′ tending to reduce the slippage while loosening it gives the reverse action.

With the wheel 23 drawn up as above indicated the pulley 10 may be revolved in a counter-clockwise direction, Fig. 1, with the plate 15 traveling therewith. Now should the pulley 10 be revolved in the reverse or clockwise direction, the cam 24 being in rotative contact with the plate 15 tends to revolve in the opposite direction whereby the higher projection of it is carried around with the aid of the spring 25 to tend to press against the plate 15 to prevent rotation of it. Continued rotation of the pulley 10 will force the cam 24 into engagement with the plate 15 to such an extent that the plate 15 will be held stationary after which the pulley 10 can only be revolved against the frictional drag of the facing 14 pressing thereagainst by the then stationary plate 15.

I find an immediate and highly desirable application of my invention to an exercising or rowing machine as illustrated in Figs. 3 and 4. For such a device I form a rectangular frame having the side rails 28 and 29, the rear cross member 30 and a forward cross member 31. The forward cross member 31 consists of an angle bar placed across the top sides of the side rails and spaced rearwardly somewhat from the forward ends thereof. On the forward side of the rail 31 I mount an assembly which is substantially a combination of two of the units above described, as best indicated in Fig. 5.

In this form I provide the brackets 32 and 33 which carry the shaft 34 therebetween. One end of the shaft 34 has a cone 35 screw-threadedly engaging thereon and abutting the inner side of the bracket 32. A nut 36 screw-threadedly fits about the outer end of the shaft 34 and is drawn up tightly against the outer side of the bracket 32 to retain the shaft 32 in a fixed position. A plate 37 similar to the plate 15 above described carries the ball bearings 38 to ride on the cone 35, the plate 37 being rotatively carried on the shaft 34. A pulley 39 is rotatably carried on the shaft 34 adjacent the plate 37 with a friction disc 40 therebetween. The pulley 39 has a hub 41 projecting laterally along and about the shaft 34 to be abutted by the oppositely disposed hub 42 on the pulley 43.

Beyond the pulley 43 is a friction disc 45 and a plate 46 rotatably mounted on the shaft 34, a ball bearing 47 being carried in the outer end of the plate 46 to ride about the cone 48 which is slidably carried on the shaft 34. The shaft 34 extends outwardly beyond the bracket 33 through a sleeve 44 to screw-threadedly carry on the projecting end the hand wheel 49. The brackets 32 and 33 are fixed on the forward face of the vertical leg of the cross member 31 to extend substantially horizontally therefrom and to carry the pulleys 39 and 43 forwardly thereof.

A cam 50 is rotatably supported by the bracket 32 to have its periphery maintained in rolling contact with the periphery of the plate 37 by means of the spring 51. Similarly the cam 52 is held in rotative contact with the plate 46 by means of the spring 53.

A coil spring 54 is fixed by one end to the rear cross member 30 and to its forward end is attached a rope 55 which is carried forwardly under, around, and over the pulley 39 and down rearwardly under the roller 56 which is rotatably carried on the transverse shaft 57 to carry the hand grip 58 on its end. In the same manner, a spring 59 is fixed to the cross member 30 to have a rope 60 fixed to its forward end, which rope is carried forwardly under the pulley 45, over, and around under the roller 61 also rotatably carried on the shaft 57, and out therefrom to carry the hand grip 62. The shaft 57 is supported by being passed through the brackets 32 and 33 and is fixed thereto by the set screws 63. The rollers 56 and 61 are maintained in spaced alignment with the pulleys 39 and 43 respectively by the M-shaped bracket 64 which is fixed to the shaft 57 by the set screw 65 to have the bracket depending from the shaft so as to serve also as means for guiding the ropes 55 and 60 as they may return under the rollers.

Foot pedals 65′ and 66 are rotatably mounted on ends of the shaft 57 which extend beyond the brackets 32 and 33, the pedals being retained on the shaft by means of set screws screw-threadedly passed through the hubs of the pedals and slidably entering annular grooves 67 about the shaft. A foot board 68 is mounted across the rails 28 and 29 adjacent the front member 31 and a seat 69 is provided to be moved along the rails. The seat is essentially an inverted box carrying the transverse axles 70 and 71 between the sides thereof, on the outer ends of which within the box are rotatably mounted the flanged wheels 72 which roll on the top edges of the side rails 28 and 29 with their flanges on the outer sides of the rails.

Midway between the axles, an arm 73 is fixed to each side of the box to extend inwardly and downwardly and thence around slidably under the top rail flange, Fig. 7, as a means for preventing displacement of the seat from the rails. The rear edge of the seat is provided with an apron 74 which extends downwardly sufficientlv so as to strike the cross member 30 upon shifting of the seat that far back. Legs 75 are provided at the rear of the rails 28 and 29 to lift and hold the rails in an inclined position and castors

76 are provided at the forward end of the rails as means permitting the easy shifting of the entire apparatus about over the floor by lifting the rear end.

When the device is to be operated, the operator either sits upon the seat 69 and puts his feet on the pedals 65 and 66 or stands on the board 68, and in either position grasps the grips 58 and 62 with his hands and pulls thereon against the resistance of the springs 54 and 59 which is easily overcome. Resistance to pull is increased by tightening up the hand wheel 49 which action tends to press the plates and the intervening discs against the pulleys 39 and 43, and, since the pulleys are being revolved by the travel of the ropes thereover in the direction to cause the cams 50 and 52 to engage the plates 37 and 46, the resistance is then set up by the degree of slippage permitted between the plates and pulleys through adjustment of the hand wheel 49. Upon cessation of pull on the ropes, the springs 54 and 59 will return the ropes to their original positions since the pull of the springs will pull on the ropes to revolve the pulleys 39 and 43 in the reverse direction to rock the cams 50 and 52 away from engagement with the plates, thereby permitting the plates to revolve freely with the pulleys without the pulleys having to slide thereover as in the original travel.

Referring to Figs. 8 and 9 in the drawings, a very efficient modification of the plate arresting means is shown. In this form, I provide an annular laterally projecting ring 78 on the face of the plate 37′ and mount a dog 79 between the bracket 32 and the plate 37′ to be supported at one end by a pin 80 fixed to the bracket 32 and extending through the slot 81 in the end of the dog. The other end of the dog is provided with a slot 82 across the vertical face toward the plate, the slot being somewhat wider than the width of the ring 78 and receiving the ring therethrough. A stop bar 83 is fixed to the bracket 32 about the dog 79 to limit the upward travel of the dog to substantially a line passing through the pin 80 and the center of the plate 37′. A spring 84 bears between the stop 83 and the top of the dog 79, normally rocking the dog downwardly as indicated in Fig. 9.

When the pulley 39 revolves in a clockwise direction, Fig. 9, the plate 37′ will tend to revolve likewise and the dog 79 will tend to travel therewith by its free end as directed by the spring 84. However, since the dog is supported at its other end, it will tend to rock about the ring 78 and force the lower and upper corners or edges of the opposing faces of the slot 82 to grip against the inner and outer peripheries of the ring with the result that the plate 37′ is securely gripped thereby and held against rotation. The slightest movement of the plate 37′ in the opposite direction releases the grip of the dog on the ring since the dog is lifted thereby. The corners or edges above referred to need not be sharpened as experience has shown that they may even be rounded and still hold since it is the leverage action and not a cutting action that causes the dog to hold the plate, similar to the action of bending a flat bar by means of a monkey wrench.

I claim:

1. In a variable frictional resistance device, a revolvable pulley member, a frictional contacting disc member adjacent the revolvable member, means for varying the pressure between the revolvable and contacting members, and means permitting revolution of the contacting member with the revolvable member in one direction but preventing revolution in the reverse direction.

2. The combination of a shaft, a pulley and a plate adjacent the pulley revolvably carried about the shaft, means for selectively moving the pulley and the plate relatively toward each other, and a member adapted to hold the plate against rotation in one direction and to allow rotation in the reverse direction.

3. The combination of a shaft, a pulley and a plate adjacent the pulley revolvably carried about the shaft, means for selectively moving the pulley and the plate relatively toward each other, and a member adapted to hold the plate against rotation in one direction and to allow rotation in the reverse direction, a rope about the pulley, and a spring normally returning the rope about the pulley in said reverse direction.

4. In a friction controlled device, a pulley, a rope carried around said pulley, a spring normally carrying the rope around the pulley, frictional disc means adapted to resist travel of the pulley under pull of the rope against the pull of the spring, and cam means automatically relieving said resistance upon reverse travel of the pulley.

5. In an exercising device, a seat, a pulley mounted forward of the seat, a rope about the pulley, a spring normally carrying the rope around the pulley away from the seat, a friction disc adjacent the pulley, means comprising a plate, a sleeve, and threaded means for pressing the sleeve against the plate for varying the pressure of the friction disc against the pulley, said friction member being adapted to be revolved with the pulley, means adapted to engage said friction member and hold it against rotation during travel of the rope toward said seat and to release said friction member during reverse travel of the rope.

6. The combination of a pair of brackets, a shaft carried by the brackets, a plate and an adjacent pulley each revolvably carried on the shaft between said brackets, means

cooperating with said shaft to draw said plate compressively against the pulley and a member carried by one of the brackets in movable contact with said plate.

7. An exercising device embodying a rope adapted to be pulled, means normally returning the rope, and a frictional mechanism comprising a pulley, a friction disc and adjustable means for contacting the pulley and disc for selectively varying the resistance to the pull on the rope.

8. The combination of a pair of brackets, a shaft carried by the brackets, a plate and an adjacent pulley each revolvably carried on the shaft between said brackets, means cooperating with said shaft between said brackets to draw said plate compressively against the pulley, and a shiftable member carried by one of the brackets in rotative contact with said plate, said means comprising a hand wheel screw-threadedly engaging an end of said shaft projecting beyond one of said brackets.

9. An exercising device embodying a rope adapted to be pulled, means normally returning the rope, and a frictional mechanism comprising a pulley, a friction disc and adjustable means for contacting the pulley and disc for selectively varying the resistance to the pull on the rope, and means automatically relieving said resistance upon return travel of the ropes.

10. An exercising device embodying a rope adapted to be pulled, means normally returning the rope, and a frictional mechanism for selectively varying the resistance to the pull on the rope, said frictional mechanism automatically relieving said resistance upon return travel of the rope, and comprising a pulley over which the rope is pulled, a friction plate adapted to be pressed against the pulley, and a cam in rotative contact with the plate.

11. An exercising device embodying a rope adapted to be pulled, means normally returning the rope, and a frictional mechanism for selectively varying the resistance to the pull on the rope, said frictional mechanism automatically relieving said resistance upon return travel of the rope, and comprising a pulley over which the rope is pulled, a friction plate adapted to be pressed against the pulley, a ring on the plate, a dog rockably supported adjacent the plate, said dog having a notch across one side through which said ring may travel, and stop means limiting the rocking of the dog in one direction.

12. The combination of a pulley, a frictional member adapted to revolve with the pulley, and a cam member automatically holding the frictional member against rotation in one direction of rotation of the pulley and releasing it in the other direction.

13. The combination of a pulley, a frictional member adapted to revolve with the pulley, and a member automatically holding the frictional member against rotation in one direction of rotation of the pulley and releasing it in the other, said frictional member having an annular, laterally extending ring, and said member being supported by one end and having a notch across a side near the other end through which notch said ring may travel.

14. The combination of a pulley, a frictional member adapted to revolve with the pulley, and a member automatically holding the frictional member against rotation in one direction of rotation of the pulley and releasing it in the other, said frictional member having an annular, laterally, extending ring, and said member being supported by one end and having a notch across a side near the other end through which notch said ring may travel, and means for variably pressing said frictional member toward the pulley.

15. In combination with a revolvable driven member and a frictional member, an annular ring carried by the frictional member, a dog having a slot across one face toward one end thereof, through which slot said ring may travel, and means supporting the other end of the dog, said other end of the dog being slotted at right angles to the plane of rotation of said frictional member, and said supporting means consisting of a relatively fixed frame, a pin supported from the frame and passing through the slot in the end.

16. In combination with a revolvable driven member and a frictional member, an annular ring carried by the frictional member, a dog having a slot across one face toward one end thereof, through which slot said ring may travel, and means supporting the other end of the dog, said other end of the dog being slotted at right angles to the plane of rotation of said frictional member, and said supporting means consisting of a relatively fixed frame, a pin supported from the frame and passing through the slot in the end, and spring means between the frame and body normally rocking said dog about said pin to remove said dog from a line through said pin and the center of said frictional member.

17. In combination with a revolvable driven member and a frictional member, an annular ring carried by the frictional member, a dog having a slot across one face toward one end thereof, through which slot said ring may travel, and means supporting the other end of the dog, said other end of the dog being slotted at right angles to the plane of rotation of said frictional member, and said supporting means consisting of a relatively fixed frame, a pin supported from the frame and passing through the slot in the end, and spring means between the frame and body normally rocking said dog about said pin to remove said dog from a line through said pin and the center of said frictional member, said

dog contacting a frame extension to limit the return travel of the dog against the pressure of the spring to substantially said line.

18. The combination of a pulley, a frictional member adapted to revolve with the pulley, and a member automatically holding the frictional member against rotation in one direction of rotation of the pulley and releasing it in the other direction, said holding member comprising a plate contacting the frictional member and a rotative cam adapted to be moved into contact with the plate.

19. The combination of a pulley, a frictional member adapted to revolve with the pulley, and a member automatically holding the frictional member against rotation in one direction of rotation of the pulley and releasing it in the other direction, said holding member comprising a rotative cam spring pressed against a periphery of the frictional member, the cam being rotative in the same plane of rotation.

In testimony whereof I affix my signature.

JOSEPH H. STALEY.