J. W. TUDOR.

STARTING DEVICE FOR ENGINES.

APPLICATION FILED MAY 13, 1908.

955,017.

Patented Apr. 12, 1910.

2 SHEETS—SHEET 1.

Fig. 1

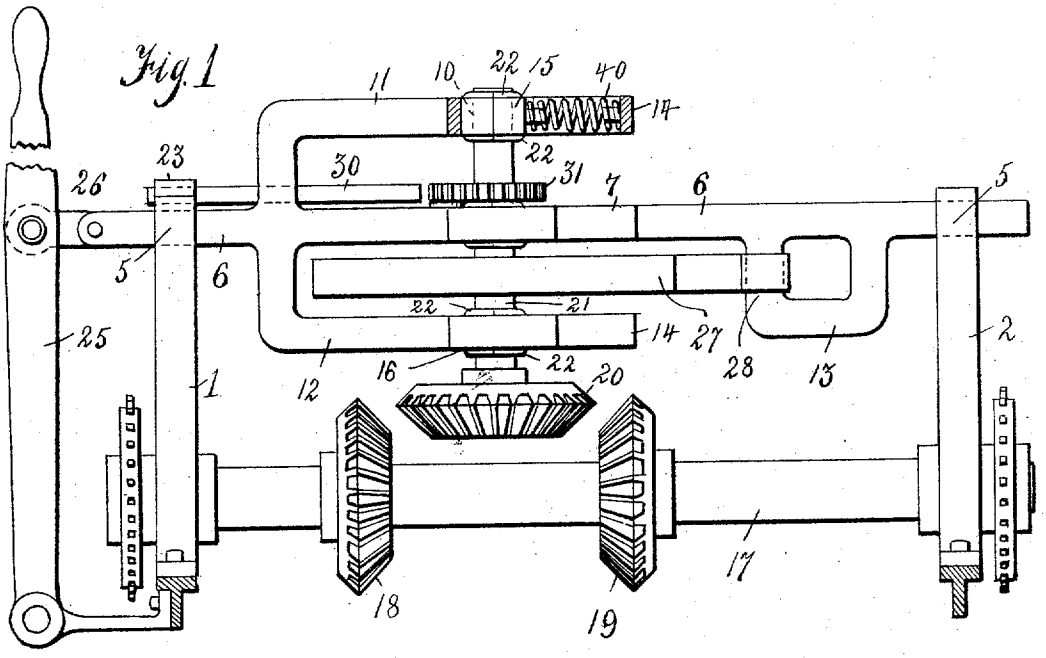
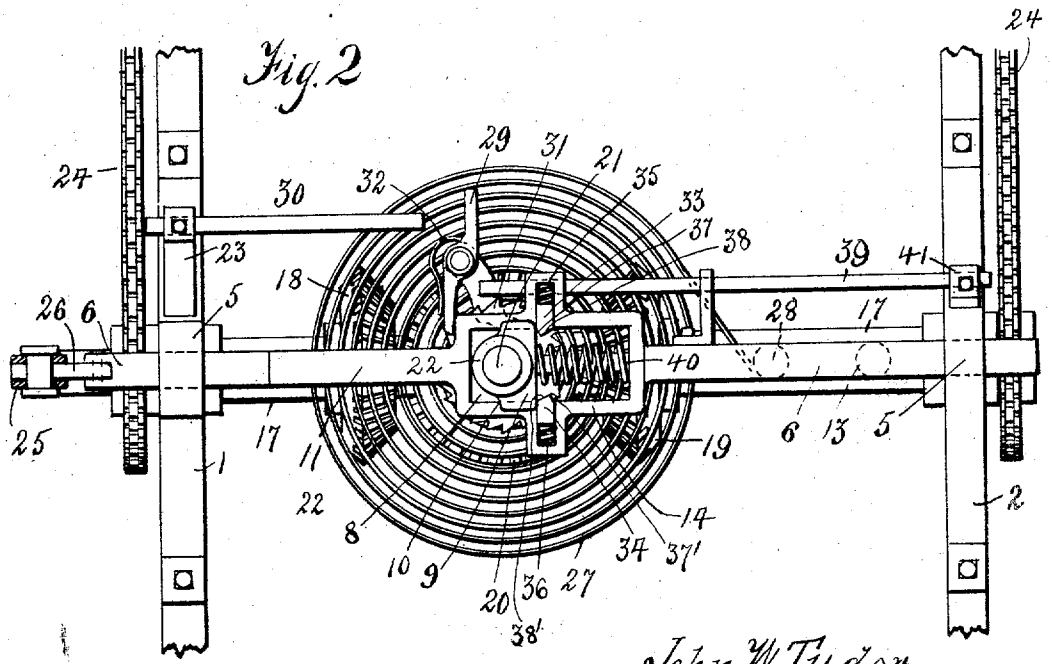


Fig. 2



John W. Tudor.
Inventor.

Witnesses
E. L. Dalton
E. N. Woodward.

By [illegible]
Atty.

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2 SHEETS—SHEET 2.

Fig. 3

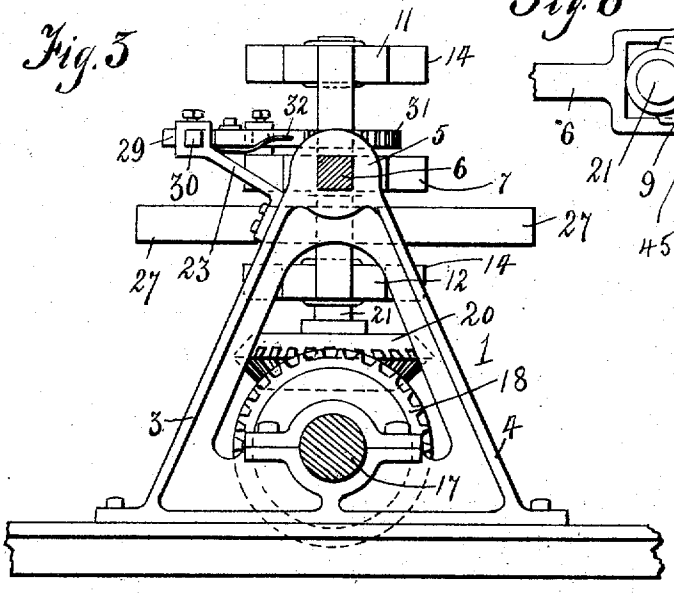

Fig. 6

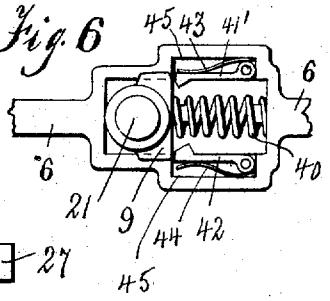

Fig. 4

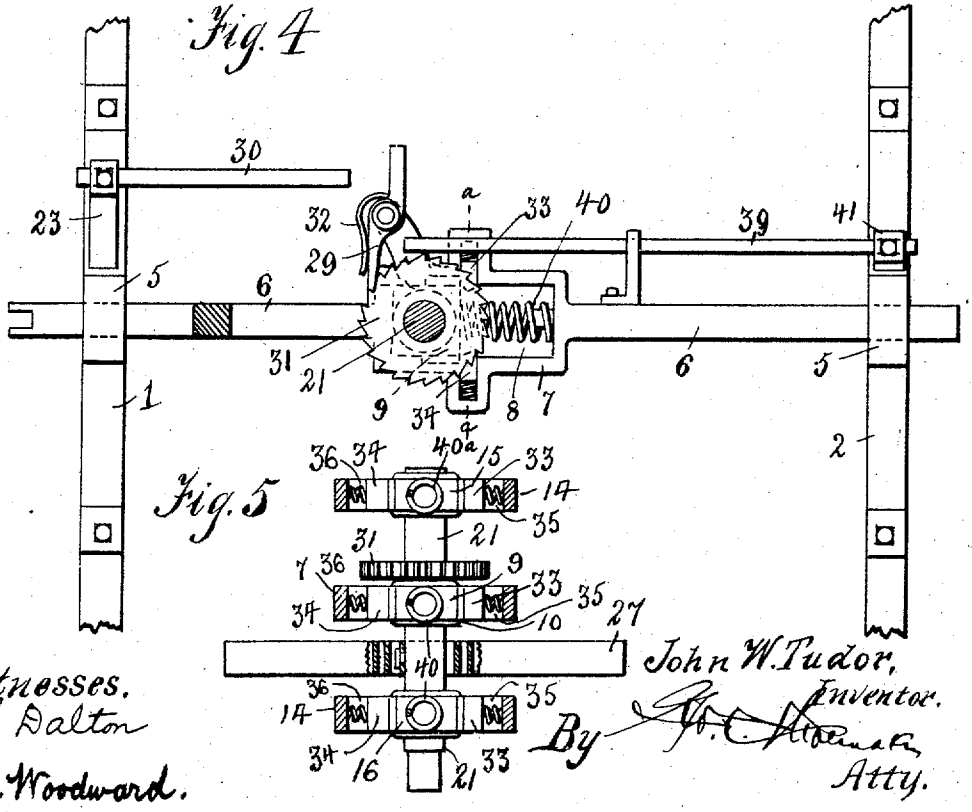

Fig. 5

Witnesses.
E. S. Dalton
E. N. Woodward.

John W. Tudor,
Inventor.
By
Atty.

UNITED STATES PATENT OFFICE.

JOHN WILLIAM TUDOR, OF BOSTON, MASSACHUSETTS.

STARTING DEVICE FOR ENGINES.

955,017. Specification of Letters Patent. Patented Apr. 12, 1910.

Application filed May 13, 1908. Serial No. 432,645.

To all whom it may concern:

Be it known that I, JOHN WILLIAM TUDOR, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Starting Devices for Engines, of which the following is a specification.

This invention relates to starting devices for engines.

One object of my invention is to provide a starting device for automobile or other engines wherein means is provided to store energy of the running engine for a fresh start, by the simple manipulation of a lever in two directions, the first movement of the lever providing for the storage of the energy and the second movement of the lever providing for the starting of the motor by the aid of the stored energy, an essential feature of the device residing in an automatic release of the device after storing the energy and again after starting the engine.

Another object of the invention is to provide a device particularly adapted to start automobile or similar engines embodying such characteristics that it may be operated to store energy for the purpose of coöperating with the motor to start the latter.

Another object resides in the provision of a device of the nature stated, whose parts are so assembled into an aggroupment of cooperative elements that energy may be stored, while the machine is running, for use to start the motor of the machine after a stop without the liability of breakage of parts or a derangement thereof.

A still further object is to provide an engine starting device comprising a longitudinally movable element having one of the operative elements of the device movable longitudinally thereof automatically and independently of the movement of the first named element.

With the above and other objects in view, the present invention consists in the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that changes may be made in the form, proportion, size and minor details without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:—Figure 1 is a side elevation, partly in section. Fig. 2 is a top plan view, with the upper arm of the frame removed. Fig. 3 is an end elevation. Fig. 4 is a top plan view with the energy spring removed. Fig. 5 is a transverse sectional view on the line *a*—*a* of Fig. 4. Fig. 6 is a detail view of a modified form of means for resisting the sliding bearings in the arms and bar.

Referring now more particularly to the accompanying drawings, the reference characters 1 and 2 indicate standards of any suitable type but each preferably of a form having downwardly diverging legs 3 and 4. These standards have their heads or upper portions each provided with a bearing 5, adapted to slidably receive the bar 6, which is preferably enlarged intermediate its ends, as at 7, the enlargement having a slot 8 to slidably receive the movable bearing 9, whose sides may be grooved, if desired, as indicated at 10 to embrace the sides of the slot 8 and be guided thereby for the purpose hereinafter stated.

The sliding bar 6 forms a part of a frame whose other parts comprise the upper and lower arms 11 and 12, respectively, and the depending supporting member 13, the outer ends of each of said arms 11 and 12 being enlarged, as at 14, and slotted to receive the slidable bearings 15 and 16 formed like the aforesaid bearing 9.

A drive shaft is indicated at 17, and extends through the legs of the standards 1 and 2 and supported in any suitable manner, there being beveled winding and unwinding gears 18 and 19, respectively, mounted upon the shaft for interchangeable engagement with the beveled gear 20 carried at the lower end of the vertical or winding shaft 21 which is mounted in the aforesaid bearings 9, 15 and 16, pairs of collars 22 being arranged upon the vertical shaft above and below the arms 11 and 12, and above and below the bar 6, as shown, to provide for a firm mounting of said shaft 21.

The drive shaft 17 may have connection with the motor, (not shown) through the instrumentality of any suitable connections, such for instance, as the chain connections 24, and the slidable frame hereinbefore referred to may be moved longitudinally in said standards in any suitable manner, one means embodying a manually operated hand lever 25 having a link connection 26 with the bar 6 of the frame.

Connected at one end to the winding shaft 21, between the bar 6 and the arm 12 is a power spring 27 whose opposite end is secured in any suitable manner to the part 28 of the aforesaid depending member 13.

The vertical shaft 21 and its beveled gear 20 are disposed normally intermediate the winding and unwinding gears 18 and 19, respectively, and these two elements are caused to assume this intermediate position automatically regardless of whether the gear 20 of the shaft 21 be in mesh with either the winding or the unwinding gear. Therefore, assuming that the vertical shaft 21 and the gear 20 are in their normal intermediate position, and it is desired to wind the energy spring, the bar 6 is moved longitudinally to the left by throwing the operating lever 25 to the left from its normal or full line position (Fig. 1), causing the gear 20 of the vertical shaft 21 to be thrown from its normal position between the winding and unwinding gears 18 and 19, respectively, into mesh with the winding gear 18, which latter, owing to the operation of the drive shaft, causes the spring 27 to wind upon the vertical shaft 21. When the gear 20 and its shaft 21 are thus thrown, the pawl 29 on the slidable bearing 9 is moved upon its pivot by contact with the free end of the elongated arm 30, secured to the upper end of the standard 1 in the bracket 23, so that as the spring 27 is being wound, said pawl may be moved out of engagement with the teeth of the ratchet 31 carried by said vertical shaft 21 to permit of proper rotation of the vertical shaft, said pawl and ratchet mechanism preventing accidental unwinding of the power spring when the shaft 21 is in its normal position, that is, between the winding and unwinding gears. A spring 32 is associated with the pawl 29 to control the same and thereby hold the pawl normally in engagement with the ratchet 31 until moved upon its pivot by said arm 30, as stated.

The winding operation may take place to store up energy in the spring 27 while the machine is in motion, so that after a stop of the machine, the energy spring may be utilized to start the motor (not shown). To start the motor, subsequent to the winding up of the power spring, the lever 25 is thrown to the right, (Fig. 1), causing the gear 20 to be thrown into mesh with the unwinding gear 19 on the drive shaft 17, resulting in an unwinding of the spring 27 which acts to start the motor.

To effect the aforesaid automatic shifting of the vertical shaft 21 and its gear 20 to its normal intermediate position, I provide the aforesaid slidable bearings 9, 15 and 16. These bearings will remain normally in their initial position, that is at the inner end of their respective guide-slots, unless the energy spring be wound beyond a certain degree of tension. If the spring 27 is wound beyond its normal highest tension, the gear 20 on the vertical shaft 21 will be pulled automatically from engagement with the winding gear 18 incident to the pulling action of the spring 27 upon the winding shaft 21 causing a sliding movement of said bearings, and by virtue of which the tension of the power spring is released prior to its reaching a "breaking stress". However, before the gear 20 is pulled away automatically from the winding gear 18, the energy spring tension must reach such a point as to overcome the tension of the spring pressed pawls 33 and 34 mounted in the sockets 35 and 36, respectively, of the enlarged portions 7 and 14 of the bar 6 and arms 11 and 12, respectively.

The pawls 33 and 34 each have reversely inclined outer ends, one inclined face 37—37′ of each pawl 33 and 34, respectively, being shorter and more abrupt than its other inclined face 38—38′ of the respective pawls, which latter abruptly inclined faces are longer than the other inclined faces, so that when the corresponding slidable bearing is pulled out of its normal position in its guide-way against the action of said spring pressed pawls and the spring 40, the pawls 33 of the respective guide-ways will resist movement of the corresponding slidable bearings. This resistance by the slidable bearings is eventually overcome to the extent of permitting the slidable bearings to move longitudinally in their guides to shift the vertical shaft 21 and the gear 20 to a position intermediate the winding and unwinding gears. Thus the gear 20 is thrown automatically out of operative relation with the winding gear without shifting the longitudinally movable frame and without any attention on the part of the operator of the machine.

By virtue of the aforesaid spring pressed pawls 33 and 34 and the springs 40, it is not likely that the energy spring would reach such a tension as to cause the slidable bearings to be shifted to the extreme outer end of their guide-ways. However, if by a possibility the tension of the energy spring should overcome the spring pressed pawls and springs 40 to such an extent as to throw the gear 20 of the vertical shaft 21 into mesh with the unwinding gear, the energy spring would be quickly relieved of its overload of tension incident to the unwinding operation and prior to a complete unwinding thereof, the springs 40 would automatically shift the vertical shaft 21 and its gear 20 to their normal intermediate position.

When the energy spring is utilized to start the motor, that is, when the gear 20 of the shaft 21 is thrown into mesh with the unwinding gear 19, by shifting the longitudinally movable frame, the slidable bearings

will return to their normal positions without shifting the longitudinally movable frame so as to dispose the gear 20 in its normal intermediate position automatically, although this automatic shifting of the gear 20 to its normal intermediate position out of engagement with the unwinding gear will not take place until the power spring has lost practically, if not all, of its tension, incident to its unwinding.

There is an enlongated arm 39 on the standard 2 whose free end is adapted to engage the aforesaid pawl 29 if the bearing 9 reaches the outer end of its guide-way, or when the frame is shifted to throw the intermediate gear into mesh with the unwinding gear, merely for the purpose of throwing said pawl 29 away from the teeth of the ratchet 31 to obviate unnecessary wear upon the teeth of the ratchet. A bracket 41 secured to the bar 6 aids in supporting said arm 39.

In Fig. 6 I illustrate a modified form of means for controlling the movement of the slidable bearings, consisting in the pivoted pawls 41′ and 42 engaged by the spring 43 and 44, respectively, the latter pawls and springs being mounted in the sockets 45 of the guide-ways, as shown. This is an obvious variation of the form of spring pressed pawls, as compared to the first described spring pressed pawls, and illustration other than that shown in Fig. 6 seems entirely unnecessary.

Having thus described the invention, what is claimed as new is:—

1. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears, and an energy spring having connection with the second mentioned shaft and the frame.

2. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears, and an energy storing means having connection with the second mentioned shaft and the frame.

3. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a longitudinally slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears when the frame is shifted longitudinally, and an energy storing means having connection with the second mentioned shaft and frame.

4. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a longitudinally slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears when the frame is shifted longitudinally, and an energy spring connected to the second mentioned shaft and the frame.

5. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a longitudinally slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears when the frame is shifted longitudinally, an energy spring having connection with the second mentioned shaft and the frame, and means for shifting the frame longitudinally to throw the gear of the second mentioned shaft into mesh interchangeably with the gears of the drive shaft.

6. In an engine starting device, a drive shaft, spaced gears upon the drive shaft, a longitudinally slidable frame, a shaft mounted in the frame, a gear at one end of the second mentioned shaft for mesh interchangeably with the aforesaid gears, and an energy spring having connection with the second mentioned shaft.

7. An engine starting device comprising standards, a frame mounted for sliding movement in the standards, a shaft carried by the frame, and movable therewith, and means constructed and arranged to permit of movement of said shaft longitudinally of the frame independently of movement of the latter, and an energy storing means operable by said shaft.

8. In an engine starting device, a drive shaft, spaced gears on the drive shaft, a slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears, a spring having connection with the second mentioned shaft and the frame, and means constructed and arranged to shift the second mentioned shaft and its gear automatically away from either of the other gears.

9. In an engine starting device, a drive shaft, spaced gears on the drive shaft, a slidable frame, a shaft carried by the frame, a gear carried by the second mentioned shaft for interchangeable engagement with the aforesaid gears, a spring having connection with the second mentioned shaft and the frame, and means constructed and arranged to shift the second mentioned shaft and its gear automatically away from either of the other gears to an intermediate position between the latter.

10. In an engine starting device, a longitudinally movable member, a drive shaft, a second shaft mounted for an automatic shifting longitudinally of said member in either direction and independently of the movement of the member, and a gear mechanism between said shafts.

11. In a device of the character described, a drive shaft, a frame, a spring having connection with the frame, means movable in one direction to cause winding of said spring, means to effect an automatic release of the winding means when the spring has reached a certain tension, means whereby the spring may be unwound when the first mentioned means is again moved, and means to effect an automatic release of the unwinding means when the spring has been unwound.

12. In an energy storing device, a frame, a drive shaft, a shiftable shaft, and an energy storing spring having its ends fixedly mounted, one end mounted on the shiftable shaft whereby the points of connection of the springs are at variable distances apart incident to the shifting of the shiftable shaft.

13. In a starting device, an energy storing device, means for operating said device to store the energy, said device itself automatically throwing said operating means out of operation, means for resisting operation of the last mentioned means, means whereby the stored energy in said device may be utilized, means for automatically throwing said utilizing means out of operation, and means for resisting operation of the last mentioned automatic means.

14. In a starting device, an energy storing device, means for operating said device to store the energy, said device itself throwing said operating means out of operation, means for resisting operation of the last mentioned means, means whereby the stored energy in said device may be utilized, means for throwing the utilizing means out of operation, and means for resisting operation of the last mentioned means.

15. In an energy storing device, a frame, a drive shaft, a shiftable shaft, an energy storing spring having its ends fixedly mounted, one end mounted on the shiftable shaft whereby the points of connection of the spring are at variable distances apart incident to the shifting of the shiftable shaft, means operable to effect a winding of the spring to store the energy, said spring effecting an automatic release of the winding means, means whereby the stored energy in said spring may be utilized, and means for automatically throwing said utilizing means out of operation.

16. In a starting device, a frame, a drive shaft, a shiftable rotatable shaft, an energy storing spring having one end fixed to said shiftable shaft with its opposite end fixedly secured to the frame, and means operable to shift the shiftable shaft for rotation thereof to wind the spring, said spring automatically effecting a release of the winding means, the points of connection of the spring with the frame and the center of winding at the point of connection with the shiftable shaft causing the ends of the spring to assume variable distances apart incident to the winding operation and automatic release of the winding operation.

17. In a starting device, a slidable frame, a drive shaft, a shaft revolubly mounted in said frame, a gear connection between said shafts, a spring having connection with the second shaft, means for shifting said frame and its shaft to effect a winding of said spring, said spring upon reaching a certain tension effecting a release of the winding means, means for unwinding the spring, and means for effecting a release of the winding means.

18. In a starting device, a frame, a drive shaft, a shiftable rotatable shaft, an energy storing spring having one end fixed to said shiftable shaft with its opposite end fixedly secured to the frame, means operable to shift the shiftable shaft to wind the spring, said spring automatically effecting a release of the winding means, the points of connection of the spring with the frame and the center of winding at the end connected with the shiftable shaft causing the ends of the spring to assume variable distances apart incident to the winding operation and the automatic release of the winding operation, means whereby the stored energy in said spring may be utilized, and means for automatically throwing said utilizing means out of operation.

19. In a starting device, a frame, a drive shaft, a shiftable shaft, connections between the two shafts to effect a turning of the shiftable shaft, an energy storing spring having one end fixedly secured to the shiftable shaft with its opposite end fixedly secured to the frame, means whereby the shiftable shaft may be shifted manually, and means whereby the shiftable shaft may be shifted automatically, whereby the tension of the spring incident to winding causes one end of the spring to assume variable distances from the point of resistance at the opposite end of the spring incident to the fixed connection of said opposite end of the spring to the frame.

20. In an energy storing device, a frame, a drive shaft, another shaft movably mounted, and an energy storing spring having connection at its ends with said frame and said second shaft, whereby the points of connection of the spring are at variable distances apart.

21. In a starting device, a frame, a drive shaft, an energy storing spring having its ends mounted at variable distances apart, means for winding the spring and pulling the ends thereof toward each other incident to the winding operation to effect an automatic discontinuance of the winding operation.

22. In a starting device, a drive shaft, an

energy storing spring, means for fixedly securing the ends of the spring, connections between the spring and the shaft, means operable to effect a winding of the spring to store the energy, means operable to effect an automatic release of the winding means and draw the ends of the spring toward each other, means whereby the stored energy in said spring may be utilized, and means operable to automatically throw the utilizing means out of operation and again shift the ends of the spring away from each other, whereby the points of connection of the spring assume various distances apart in the operation of the device.

23. In a starting device, a drive shaft, an energy storing spring, means for fixedly securing the ends of the spring, connections between the spring and the shaft, means operable to effect a winding of the spring to store the energy, means operable to effect an automatic release of the winding means and draw the ends of the spring toward each other, means whereby the stored energy in said spring may be utilized, means operable to automatically throw the utilizing means out of operation and again shift the ends of the spring away from each other, whereby the points of connection of the spring assume various distances apart in the operation of the device, means for resisting said first movement of the ends of the spring toward each other, and means for resisting the second movement of the ends of the spring away from each other.

24. In a starting device, an energy storing spring, means operable to effect a winding of the spring to store the energy, one end of the spring being drawn toward the other end thereof upon the spring reaching a certain tension and thereby effecting a release of the winding means.

25. In a starting device, a supporting frame, a drive shaft, a second shaft which is rotatable and also shiftable bodily, gears operable to connect said shafts to effect rotation of the second shaft, an energy storing spring having one end fixed to the supporting frame and its opposite end fixed to said second shaft, and means whereby said second shaft may be shifted bodily to effect a connection with the drive shaft through the medium of said gears to wind the spring, said spring effecting an automatic release of the winding means and pulling that end of the spring which is secured to said shiftable shaft toward the opposite end of the spring.

26. In a starting device, an energy storing spring, means operable to effect a winding of the spring to store the energy, the ends of the spring being drawn toward each other upon the spring reaching a certain tension and thereby effecting an automatic release of the winding means.

In testimony whereof I affix my signature, in presence of two witnesses.

JOHN WILLIAM TUDOR.

Witnesses:
JOHN H. SIGGERS,
CHARLOTTE H. TUDOR.