Oct. 26, 1954 L. D. WATKINS 2,692,589

DOG CONTROL FOR RECOIL ENGINE STARTERS

Filed Jan. 5, 1949 2 Sheets-Sheet 1

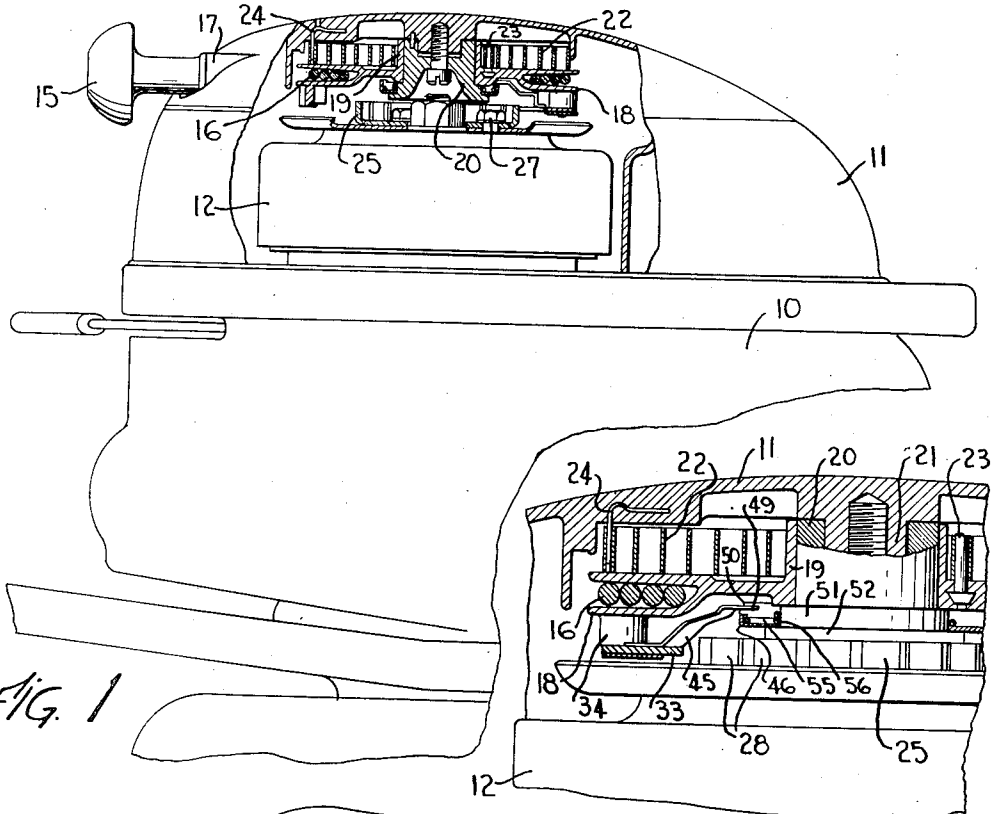


FIG. 1

FIG. 2

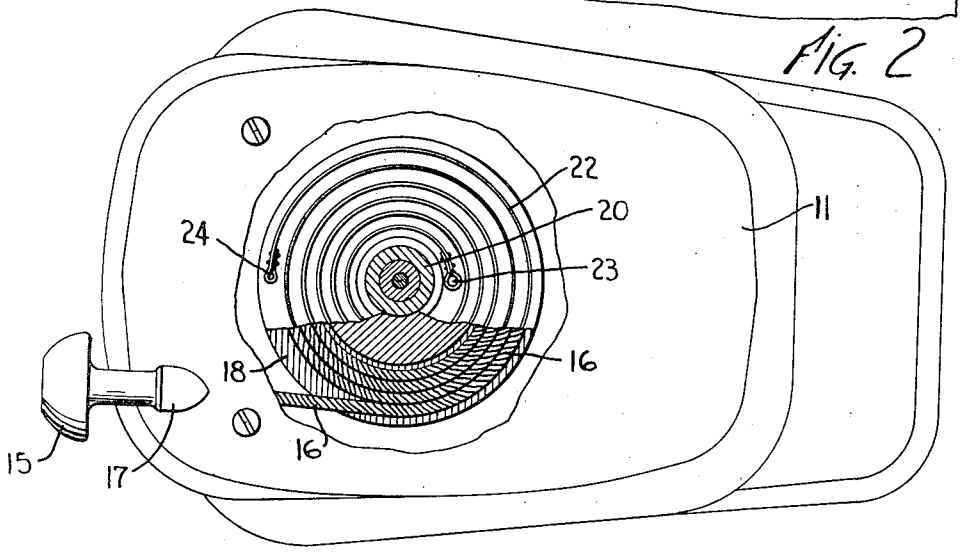


FIG. 3

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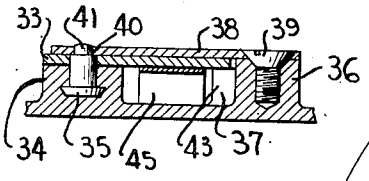


FIG. 6

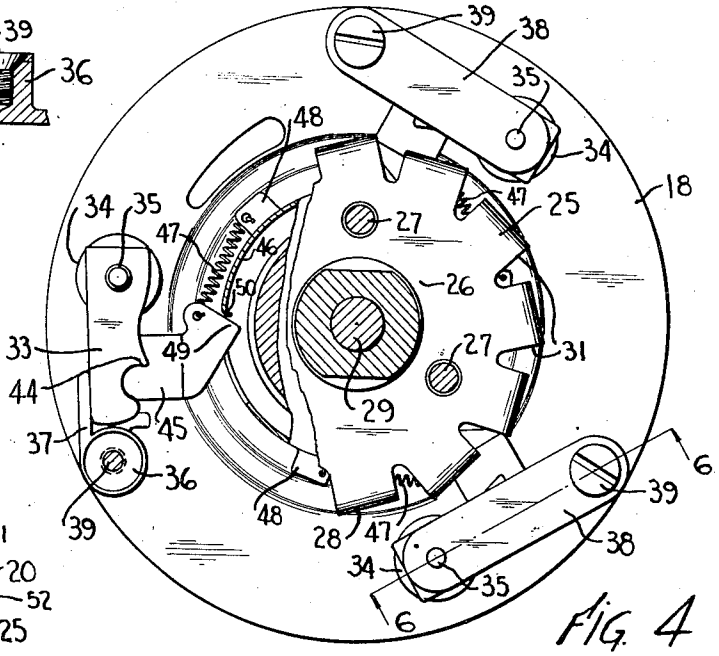


FIG. 4

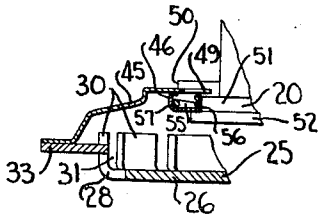


FIG. 7

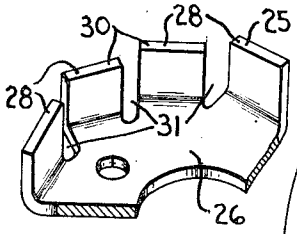


FIG. 8

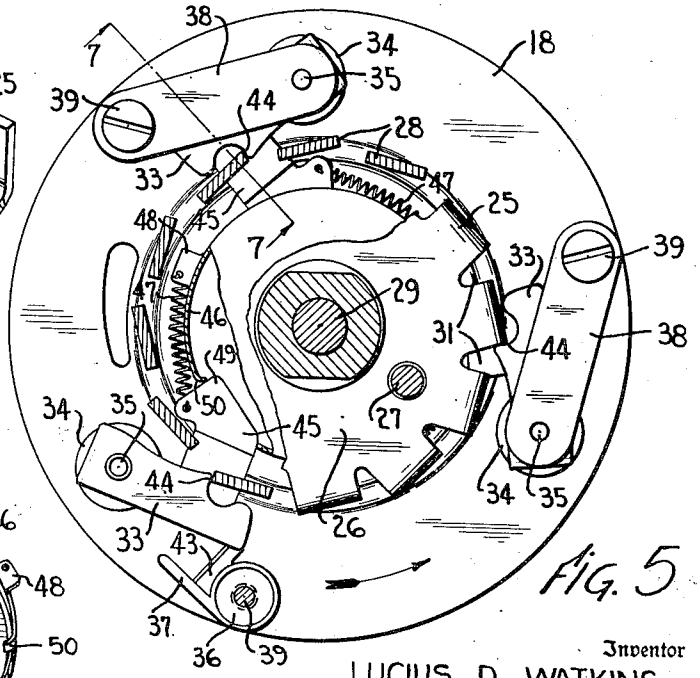


FIG. 5

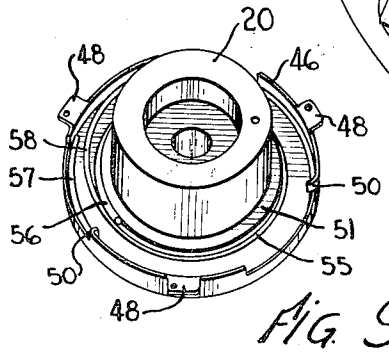


FIG. 9

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2,692,589

UNITED STATES PATENT OFFICE

2,692,589

DOG CONTROL FOR RECOIL ENGINE STARTERS

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Application January 5, 1949, Serial No. 69,314

16 Claims. (Cl. 123—185)

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This invention relates to a dog control for a recoil engine starter. It also relates to a novel ratchet wheel used therein and to a novel friction clutch which acts in each of two directions of oscillation but offers greater resistance in one direction of oscillation than in the other, the differential resistance thus achieved being of importance in a recoil engine starter.

While certain features of the invention have utility for other purposes, they can best be described as embodied in an engine starter of the type in which engine cranking operation is achieved by drawing a rope from a drum and winding a spring which, upon release of the rope, recoils it upon the drum. In such a device, it is desirable to provide means for projecting the dogs or pawls mechanically into operative relation to a ratchet disk and to retract them mechanically during the rope rewinging operation. The mechanical actuation of the pawls is achieved, in both instances, by the frictional drag between a pawl actuating sleeve and other parts. It is an object of the invention to make this drag relatively great at the time the pawls are to be projected in the starting operation and to make the drag relatively slight during the rewinding operation so that the rewinding spring will not have to exert a great deal of energy beyond that required to recoil the rope.

Other objects of the invention can best be explained in connection with the following disclosure thereof, with particular reference to the accompanying drawings in which

Fig. 1 is a view partially in side elevation and partially in section showing an outboard motor power head equipped with a starter embodying the invention.

Fig. 2 is a fragmentary enlarged view in detail taken in section through a portion of the mechanism shown in Fig. 1.

Fig. 3 is a view partially in plan and partially broken away to show different horizontal sections.

Fig. 4 is an inverted plan view of the starter mechanism showing portions thereof broken away in horizontal section.

Fig. 5 is a view similar to Fig. 4 showing the parts in different relative positions.

Fig. 6 is a view taken in section on the line 6—6 of Fig. 4.

Fig. 7 is a view taken in section on the line 7—7 of Fig. 5.

Fig. 8 is a fragmentary detail view in perspective of a portion of a novel ratchet member used in the pawl control device.

Fig. 9 is a detail view in perspective of a novel friction clutch with different frictional resistance as used in the device.

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Since the present invention is not concerned with the outboard motor power head except as a means of exemplifying the use of the invention, the details of the power head will not be described. The power head may be of any desired type such as conventionally includes an engine housing at 10 provided with a top closure 11 within which there is exposed the fly wheel magneto 12 between which and the closure 11 the starter mechanism is assembled.

The starting handle 15 is attached at the end of a starting rope 16 which extends through a guide 17 in the cover 11 and is wound upon a drum or sheave 18 (Fig. 1 and Fig. 2) which is provided with a hub 19 and rotates upon a bushing 20, the latter being fixed to a stud 21 carried by the cover. The handle 15 is pulled to unwind the rope 16 from sheave 18, and thus to rotate the hub 19 for an engine starting operation as hereinafter described, a coil spring 22 is wound up, the inner end of the coil spring having a connection at 23 to the sheave and a connection at 24 to the cover (Fig. 2). When the rope is released, the reaction of the coil spring rotates the sheave or drum in a direction to rewind the rope thereon and to draw the handle 15 back into contact with the guide stop 17 on the cover.

It is contemplated that when the rope is pulled to rotate the sheave against the bias of the coil spring, rotation will be communicated to fly wheel 12 to crank the engine. When the coil spring is rotating the sheave to recoil the rope, the resistance to the movement of the sheave or drum should be as light as possible, so that an unduly heavy spring is not required. The greater the required strength of the spring, the greater will be the resistance thereof which must be overcome by the operator in the engine cranking operation.

Ratchet and pawl mechanisms communicate the rotative movement of the sheave to the fly wheel in a cranking direction but preclude transmission of rotation from the fly wheel to the sheave. The ratchet wheel 25, a detail of which is shown in Fig. 8, comprises a disk 26 held by screws 27 to the fly wheel. From the periphery of the disk, arms 28 project in directions slightly inclined with reference to the radius of crank shaft 29. The ends of these arms are turned upwardly at 30, as shown in Figs. 7 and 8, and the oblique angle at which they are disposed exposes their margins 31 to serve as ratchet teeth as best shown in Figs. 4, 5, 7 and 8.

The dogs or pawls 33 are mounted on posts 34

which project downwardly from the sheave 18. Each of these posts has an integral pin 35 upon which the respective pawl is pivoted. A companion post 36 located nearby has an integral arm 37 against which the pawl seats when retracted as shown in Fig. 4. A keeper plate 38 held to the companion post by a screw 39 overlies the pawl and is apertured at 40 to receive a dowel 41 at the end of pivot pin 35 as best shown in Fig. 6. The companion post may also desirably provide a bearing surface or support 43 (Figs. 5 and 6) upon which the free end of the pawl rests and is guided in its oscillation. In the particular exemplification shown, the ratchet engaging portion of the pawl is not at the extreme end thereof but is provided by a shoulder 44 which projects laterally intermediate the ends of the pawl.

The pawls are moved in unison between the retracted positions in which they are shown in Fig. 4 and the operative positions in which they are shown in Fig. 5 by a means which will now be described.

Connected to each pawl is an actuating arm 45 (Figs. 2, 4, 5 and 7) which projects upwardly to clear the ratchet wheel 25 and inwardly for interaction with drag ring 46. A tension spring 47 is anchored to the inner end of each arm 45 and to a projecting ear 48 on the drag ring. Near the spring anchorage, the free end portion 49 of each arm projects through a slot in the drag ring into engagement with the beaded margin 50 thereof.

The bushing 20 which is carried by the cover 11 has an enlarged intermediate portion 51 which supports the hub of the sheave 18. Upon this enlarged intermediate portion 51, and supported by the head 52 of the bushing, the drag ring 46 is rotatably mounted. Its general form is cup-shaped, with a central opening to receive enlarged portion 51 of the bushing, the upturned flange which provides the side wall, being notched to receive the pawls and provide the pawl engaging beads 50 as above described. The arrangement is such that in both the unwinding and the winding direction of movement of the sheave and its associated pawls, the engagement of the arms 45 with the drag ring will cause the drag ring to partake, with some lost motion, of rotation of the sheave.

The means by which greater friction is imposed upon the drag ring in one direction of rotation than in the other comprises a double coil spring 55 which, as best shown in Figs. 2, 7 and 9, comprises an inner coil 56 contractilly embracing the intermediate portion 51 of the bushing and an outer coil 57 expansively confined within the rim of the drag ring 46 and an intermediate spiral portion 58 connecting the inner and outer coils. The outer coil 57 is desirably of less extent than the inner coil. In practice, it may consist of less than one full 360° turn, as compared with the inner coil 56 which extends for somewhat more than 360° as clearly shown in Fig. 9 and Fig. 2. In addition to the matter of extent, the frictional engagement of the coils with the surfaces upon which they operate may be enhanced by so designing the inner and outer coils that one coil exerts greater pressure upon its associated surface than does the other. Thus, in practice, the coil 56 is not only of greater extent but is so designed as to be normally of materially smaller diameter than the portion 51 of the bushing against which it seats. Thus, when expanded to embrace the bushing portion 51, it exerts considerable contractile pressure thereon. The coil 57, on the other hand, is only slightly larger than the flange of the drag ring 46 within which it is confined. Thus, its expansive pressure against the drag ring is relatively light. These considerations augment, or may substitute for, the angular extent of the respective coils as a means of securing differential resistance to relative rotation of the drag ring in one direction or the other.

Each coil individually functions as a clutch. The functioning of a coil spring for clutch purposes is well known, but this spring provides two separate clutches offering different frictional resistances in their disengaging movements. When the drag ring 46 is rotated clockwise around the relatively fixed bushing as viewed in Fig. 9, the inner coil 56 will clamp itself securely to the bushing, thereby tending to brake the drag ring rotation, since any tendency of the free end thereof to slip about the bushing simply pulling the coil tighter upon the periphery of bushing portion 51. The other coil 57 will slip relatively freely within the inner periphery of the drag ring, particularly since there is less than one full turn of this coil engaged with the drag ring. This is the direction of movement of the parts which occurs when the sheave 18 is rotated in a rope winding direction by the coil spring 22. The braking friction offered by the clutch spring 55 is just sufficient so that the drag of the drag ring 46 under thrust of the free end portions 49 of the pawl actuating arms 45 is sufficient to assure the retraction of the pawls out of engagement with the ratchet teeth 31.

When the sheave is operated in an engine cranking direction by a pull on the rope 16, the pawls 33, moving with the sheave, tension the springs 47 which are connected to the pawls near their free ends. This tends to pull the drag ring 46 counterclockwise as viewed in Figs. 5 and 9. In this direction of rotation of the drag ring respecting the inner coil 56, the clutch spring has its grasp on the bushing portion 51 relieved while the outer coil 57 of the clutch spring has its expansive pressure against the drag ring increased. This requires the clutch spring to turn with the drag ring. While the inner end of the clutch spring slips around the portion 51 of the bushing, its frictional resistance to movement is relatively greater than was the case when the outer coil 57 was slipping within the drag ring. Accordingly, the tension developed in the springs 47 acting on the pawl actuating arms 45 is very substantial and the movement of the pawls into engagement with the ratchet teeth as shown in Fig. 5 is assured, the tension springs 47 storing the pawl engaging pressure momentarily if the pawls do not immediately register with ratchet teeth.

Thus, the mechanism permits all requisite drag to be developed for assuring pawl engagement when the rope is being pulled by the operator in a cranking direction and yet, due to the differential action of the dual clutch spring 55, the lesser drag developed in the drag ring for pawl retraction during the recoiling operation is reduced to a minimum which can readily be handled by the clock spring 22 which recoils the rope.

I claim:

1. In an engine cranking device operated by withdrawing a rope from a sheave, the rope being recoiled by a spring and the motion of the sheave in an engine cranking direction being communi-

cated to the engine by ratchet and pawl mechanism, the combination with the sheave and a pawl pivoted thereto, of pawl projecting and retracting mechanism which comprises a drag ring mounted for rotation respecting the ratchet, and means connecting the drag ring to the pawl for oscillation of the pawl in the course of lost motion between the sheave and the ring.

2. The device of claim 1 in further combination with friction clutch means between the drag ring and ratchet opposing drag ring rotation whereby to render its action upon the pawl more positive.

3. The device of claim 2 in which said friction clutch means includes a pair of friction brakes respectively connected to act in opposite directions of drag ring oscillation.

4. The device of claim 3 in which one of said brakes is a relatively higher resistance brake and the other a relatively low resistance brake.

5. The device of claim 4 in which said brakes comprise the terminal coils of a single spring, one of said coils being expansively engaged within the drag ring and the other of said coils being contractilly engaged with a fixed surface which said drag ring operates, said surface comprising a generally cylindrical member substantially coaxial with the drag ring.

6. In a device of the character described, the combination with a sheave having a rope coiled thereon provided with a handle, bearing means upon which the sheave is mounted for rotation, a spring biasing said sheave in a rope recoiling direction, a ratchet substantially coaxial with the sheave provided with peripherally spaced teeth, a pawl pivotally connected with the sheave for rotation therewith and movable upon its pivot between a retracted position disengaged from the ratchet and an advanced position in which it engages a ratchet tooth, and means for mechanically actuating the pawl between its advanced and retracted positions, said means comprising an arm projecting laterally from the pawl, a drag ring mounted for rotation substantially coaxially with said sheave, a brake drum substantially coaxial with the drag ring, the drag ring and said arm having interacting connecting means, and friction brake means acting between said drag ring and said drum for opposing rotation of said drag ring, whereby lost motion between said drag ring and said sheave mechanically actuates said pawl to and from its retracted position, depending on the direction of relative movement between the sheave and drag ring.

7. The device of claim 6 in which said braking means comprises a spring having an inner coil contractilly engaged with the drum and an outer coil expansively engaged with said ring.

8. The device of claim 7 in which one of the coils engaged with the drum has greater peripheral extent than the other, the direction of operation being such that the coil having the greater peripheral extent slips when the sheave is being manually operated and the coil having the lesser peripheral extent slips when the sheave is being spring operated in a recoiling direction.

9. The device of claim 8 in which the coil having greater peripheral extent is the coil engaged with the drum, such coil also having greater tension than the coil engaged with the ring.

10. In a device of the character described, the combination with a substantially coaxial sheave and ratchet wheel and drag ring and means supporting each for rotation, of a manually operable rope coiled on the sheave, a spring connected with the sheave for rotation thereof in a rope recoiling direction, and means for transmitting sheave movement in the opposite direction of rotation to the ratchet wheel, said means comprising a set of pawls pivotally mounted on the sheave for rotation therewith and movable to and from engagement with the ratchet wheel, posts carried by the sheave upon which the respective pawls are pivoted, companion posts provided with stops defining the retracted positions of the respective pawls, keepers mounted on the said companion posts and engaging the post first mentioned to confine the pawls thereon, arms projecting laterally from the respective pawls, tension springs connecting said arms with the drag ring, the drag ring and said pawls having thrust surfaces mutually engageable in a direction opposite to that of the tension of said springs, the said surfaces and springs comprising actuating connections between the pawls and the drag ring and operative in opposite relative directions of rotation thereof, a brake drum substantially coaxial with the drag ring, and a braking clutch comprising a spring having a coil encircling said drum, and a separate coil of larger radius confined within the ring, said braking clutch being adapted to induce lost motion between the sheave and the drive ring for effecting pawl movement between advanced and retracted positions.

11. The device of claim 10 in which the tension of the spring coil confined within the drag ring is lighter than the tension of the coil embracing the drum.

12. The device of claim 10 in which the ratchet comprises a mounting plate of generally circular form and upturned arms projecting from its periphery, the said upturned arms being set at an obtuse angle respecting radii drawn thereto from the center of said plate, whereby the margins of the upturned arms constitute teeth.

13. The sub-combination which comprises inner and outer generally circular members, one of which is mounted for rotation respecting the other, and a spring having a coil expansively engaged in the outer member under outward radial tension confined by said outer member, and another coil contractilly engaged with the inner member under inward radial tension confined by said inner member, said expansively engaged coil and contractilly engaged coil constituting separate clutch means respectively engaging in one direction of rotation and releasing in the opposite direction of rotation for resisting relative rotation between said members and predeterminable as to relative resistance in the respective directions of relative rotation according to the design of the respective coils.

14. The device of claim 13 in which one of said coils has greater peripheral extent than the other.

15. The sub-combination which comprises inner and outer generally circular members, one of which is mounted for rotation respecting the other, and a spring having a coil expansively engaged in the outer member under outward radial tension confined by said outer member, and another coil contractilly engaged with the inner member under inward radial tension confined by said inner member, said expansively engaged coil and contractilly engaged coil constituting separate clutch means respectively engaging in one direction of rotation and releasing in the opposite direction of rotation for resisting relative rotation between said members and pre-

determinable as to relative resistance in the respective directions of relative rotation according to the design of the respective coils, one of said coils having greater radial tension than the other.

16. The sub-combination which comprises inner and outer generally circular members, one of which is mounted for rotation respecting the other, and a spring having a coil expansively engaged in the outer member under outward radial tension confined by said outer member, and another coil contractilly engaged with the inner member under inward radial tension confined by said inner member, said expansively engaged coil and contractilly engaged coil constituting separate clutch means respectively engaging in one direction of rotation and releasing in the opposite direction of rotation for resisting relative rotation between said members and predeterminable as to relative resistance in the respective directions of relative rotation according to the design of the respective coils, the coil

engaged with the outer member having less peripheral extent and less radial tension than the other of said coils.

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