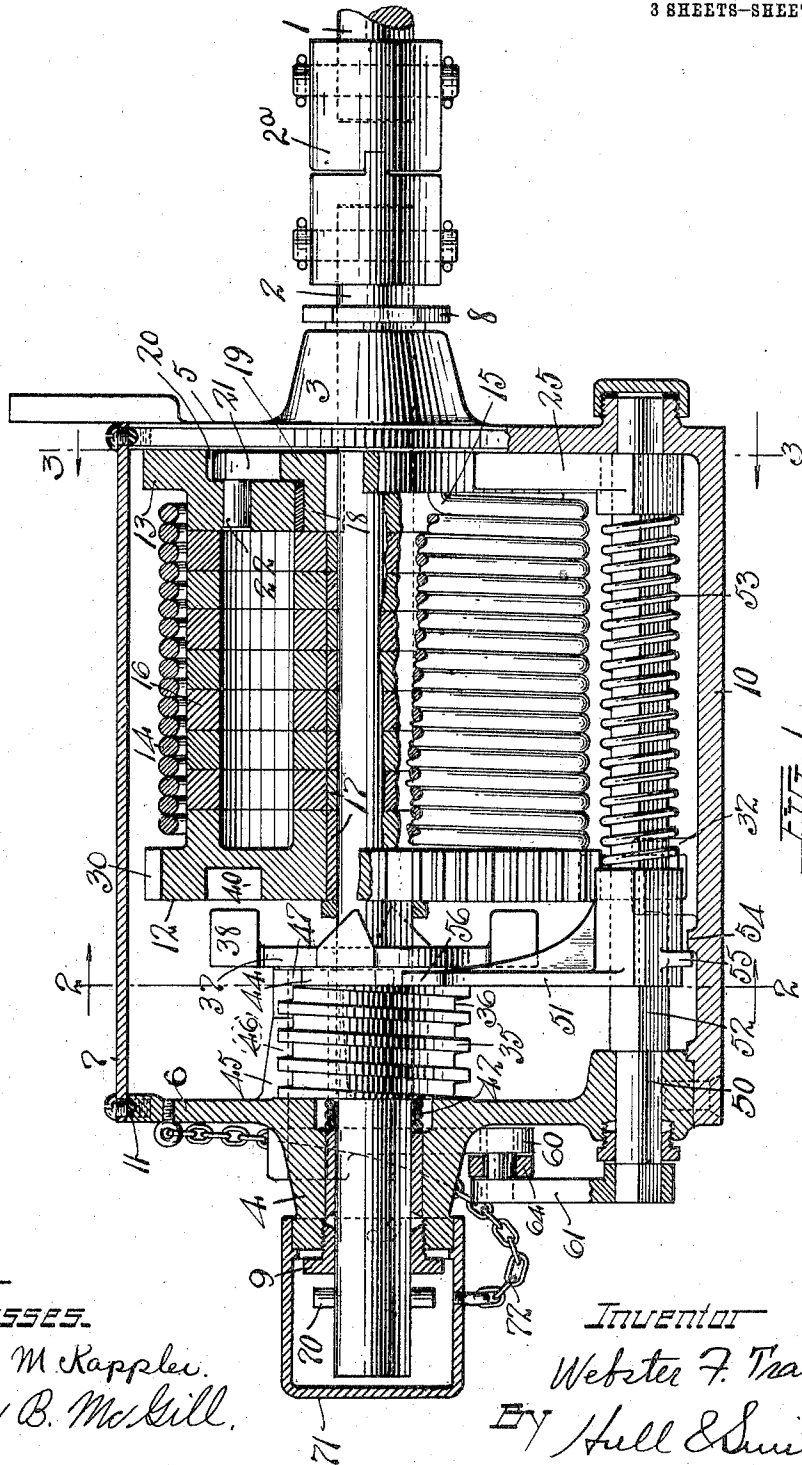


W. F. TRAVES.
 STARTING DEVICE FOR EXPLOSION ENGINES.
 APPLICATION FILED FEB. 2, 1911.

1,064,942.

Patented June 17, 1913.

3 SHEETS—SHEET 1.



Witnesses.
 Oliver M. Kappler.
 Hugh B. McGill.

Inventor
 Webster F. Traves
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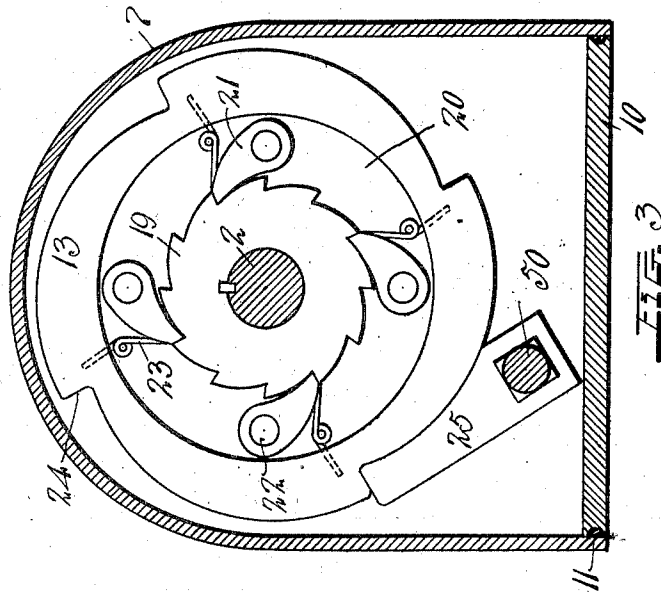


FIG. 3

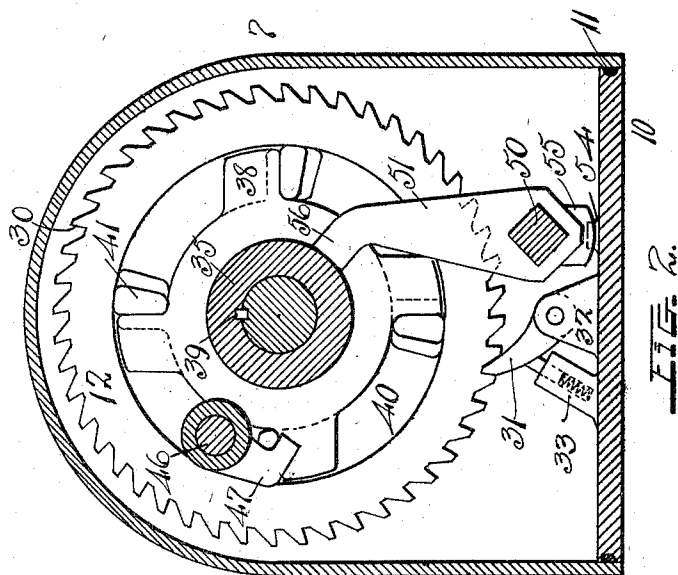


FIG. 2

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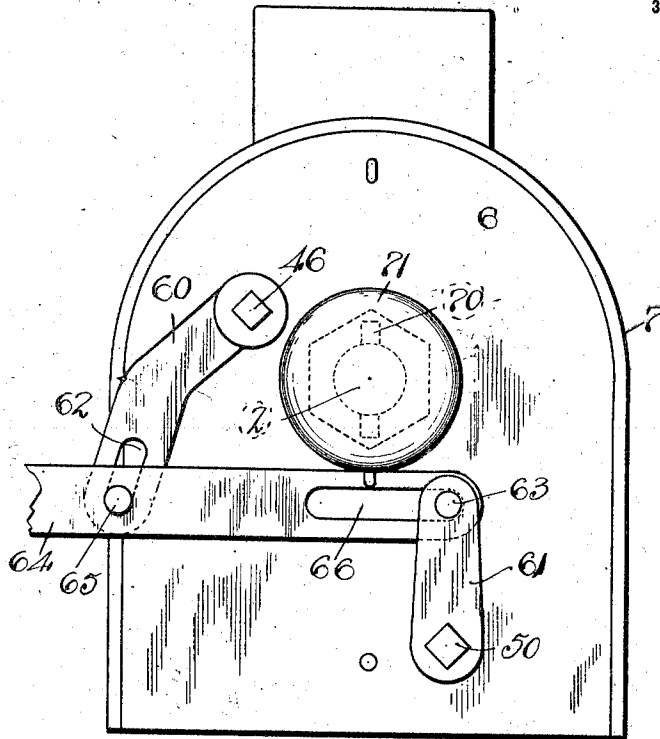


FIG. 4

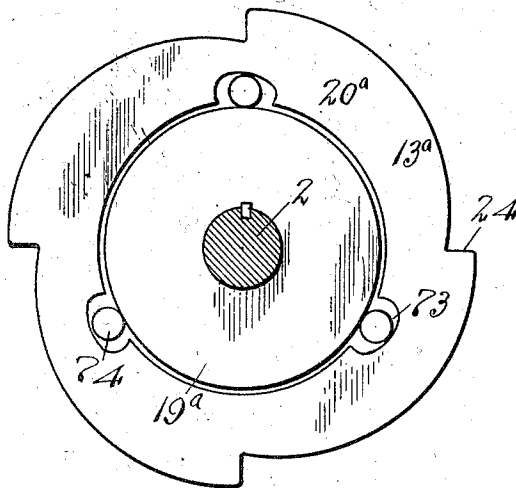


FIG. 5

Witnesses.

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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR EXPLOSION-ENGINES.

1,064,942.

Specification of Letters Patent.

Patented June 17, 1913.

Application filed February 2, 1911. Serial No. 606,227.

To all whom it may concern:

Be it known that I, WEBSTER F. TRAVES, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Starting Devices for Explosion-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to starting devices for explosion engines and has for its object the provision of a simple and compact mechanism whereby an initial rotation or series of rotations can be given to the shaft of an internal combustion engine in order to start the same from a position of rest, and which will be automatically wound up again or reset by the engine itself so as to be ready for a succeeding operation when it is next desired to start the engine.

This invention is designed particularly for use with automobile engines, though obviously it is not restricted to such use.

One embodiment of my invention is illustrated in the drawings accompanying and forming a part of this specification, in which—

Figure 1 represents a central vertical section of the complete device, portions thereof being shown in elevation; Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows; Fig. 3 is a corresponding view taken on the line 3—3 of Fig. 1; Fig. 4 is a front end view of the completed device, and Fig. 5 is a detail view of a modification.

Describing the parts by reference characters, 1 represents the engine shaft which is connected to the shaft 2 of the starter by means of a coupling 2^a which is preferably of a design to permit slight angular motion between the shafts, although as far as the operation of my starting device is concerned the same might be built directly upon the engine shaft. The shaft 2 is journaled at 3 and 4 in the ends 5 and 6, respectively, of a casing 7, said journals being preferably provided with glands 8 and 9, respectively, whereby the leakage of oil is prevented. The bottom of the casing is preferably made flat, as at 10, to form a more convenient support for a part of the internal mechanism and for the greater

ease of attachment to the support upon which it is mounted. The joints between the casing members are preferably packed, as shown at 11. Within this casing a winding drum is sleeved upon the shaft, said drum consisting essentially of two independently rotatable plates 12 and 13, the former of which will hereafter be referred to as the winding plate and the latter as the unwinding plate. These plates are yieldingly connected together by means of the torsion spring 14, the ends of which are connected to the respective plates in any convenient manner such, for instance, as shown at 15. In the preferred embodiment of my invention, these plates are spaced apart by other plates 16, all said plates being entirely disconnected from each other and having smooth abutting faces permitting them to turn over each other with minimum friction.

The plate 12 and all the plates 16 are preferably mounted upon bushings 17 loosely sleeved upon the shaft, while the plate 13 is sleeved upon the extended hub 18 of a ratchet or the like 19, which is securely keyed to the shaft 2. So far as the operation of my device is concerned, the plate 13 might as well be sleeved directly upon the shaft 2, the present construction being adapted for economy of space and for adding strength to the ratchet wheel. This ratchet is illustrated as abutting closely the end 5 of the casing, the outer face of the plate 13 being suitably recessed, as at 20, to receive the same. A plurality of pawls 21 are mounted upon pivots 22 carried by the bottom of this recess and are actuated by springs 23 to engage the ratchet 19 so as to lock the unwinding plate in driving connection with shaft 2. The periphery of the unwinding plate 13 is formed with a plurality of notches 24 adapted to be engaged by an arm or trigger 25 by means of which the starting device may be held against operation.

The winding plate 12 is formed on its periphery with a plurality of ratchet teeth 30 adapted to be engaged by the pawl 31 which is illustrated as being pivoted between standards 32 formed on the base plate 10 and impelled by the spring 33. It will now be obvious that if the winding plate 12 be rotated in the direction permitted by the pawl 31 it will store up potential energy in the spring 14 so that

upon actuation of the trigger 25 to release the unwinding plate the pawls 21 and ratchet 19 will transmit that energy to the shaft 2 so as to start the engine, after which the shaft 2 will continue to rotate freely without affecting the winding mechanism. The mechanism whereby the continued rotation of this shaft serves to rewind the starting device will next be described.

Slidably but non-rotatably mounted upon the shaft 2 adjacent the winding end of the drum is a clutch device consisting of a cylindrical body 35 having external helical grooves 36 and having at one end thereof a radial plate 37 formed with spaced engaging fingers 38 about its periphery. A feather 39 holds this body against rotation upon the shaft 2. The face of the plate 12 is formed with an annular groove 40 having therein a plurality of abutments or stops 41 equal in number to the fingers 38 and similarly spaced. A spring 42 tends to throw this body toward the winding plate 12 so as to cause the fingers 38 to engage the lugs 41.

Between the grooved portion of the body 35 and the plate 37 an annular groove 44 is formed which is slightly deeper than the grooves 36. Journaled in a bearing 45 extending inwardly from the casing end 6 parallel to the shaft 2 is a rock shaft 46 having on its inner end a finger 47 which is adapted to engage the groove 44 so as to hold the fingers 38 out of contact with the lugs 41. A second rock shaft 50 is also journaled in the casing parallel to the shaft 2 and has an arm 51 slidably but non-rotatably mounted thereon as, for instance, by being sleeved upon the square portion 52 of the shaft. This arm is yieldingly impelled away from the winding plate 12 by means of the spring 53 and its approach toward said plate is rigidly limited by the lug 54 which is adapted to engage a similar lug 55 carried by the arm. The free end of the arm is formed with a finger 56 adapted to fit in the groove 44, and the trigger 25 is rigidly secured to the further end of the shaft 50 so as to be moved simultaneously with the arm 51. The free ends of the shafts 46 and 50 extend through the front end of the casing and are there provided with lever arms 60 and 61, respectively, by means of which they may be operated. The outer end of the arm 60 is formed with a slot 62 and the end of the arm 61 is provided with a pin 63. A single operating rod 64 carries a pin 65 disposed in the slot 62 and has at its end an elongated slot 66 receiving the pin 63. This rod extends to a lever or pedal near the engine operator and is so arranged that under normal conditions the pins 63 and 65 will lie at the ends of their respective slots, as shown in Fig. 4.

The operation of the device is as follows: assume all the parts in the relation shown in

Fig. 1, the spring 14 being fully wound and the engine being still. The operating rod 64 is pushed toward the right, (Fig. 4) its first effect being to rock the shaft 46 so as to move the finger 47 into the groove 44 without at the same time having any effect on the shaft 50, owing to the lost motion caused by the slot 66. As soon, however, as the slot 66 has been traversed, the arm 61 will be moved so as to rock the shaft 50 and trip the trigger 25, thus releasing the spring and rotating the engine shaft. At the same time, the arm 51 will have been drawn out of the groove 44, whereupon the spring 53 will instantly project it to the end of its travel along the shaft 50, but the clutch member 35 will remain at the end of the shaft 2, since held by the finger 47, and the whole drum (including plates 12, 13 and 16) will be entirely free to rotate with shaft 2 or to remain stationary, depending upon whether the friction of the pawl 31 is greater or less than that of the drum upon the shaft. The operating rod 64 is now moved back into its original position, carrying with it the arm 60 but leaving the arm 61 behind, by reason of the lost motion at 66. The motion of the arm 60 now serves to move the finger 47 out of the groove 44, releasing the clutch body 35 which is now thrust by the spring 42 against the winding plate 12 so as to positively engage the same. The continuance of the motion of the operating rod will move the shaft 50 back into its original position, so as to cause the trigger 25 to relock the unwinding plate and simultaneously cause the finger 56 to drop into one of the helical grooves 36. The plate 13 now being stationary and the plate 12 revolving, the spring 14 will be rewound and the length of time during which this rewinding takes place will depend upon the number of turns of the groove 36 and upon the length of travel between the lugs 54 and 55. The spring 53 is of less strength than the spring 42, so that the first effect of the continued rotation of the body 35 is to compress the spring 53 without affecting the engagement between the fingers 38 and the stops 41. During this time the main spring 14 is being rewound. The stops 54 and 55 now come together and limit the further movement of the arm 51, whereupon the further rotation of the body 35 moves it endwise along the shaft 2 out of contact with the winding plate 12 until the finger 56 falls into the groove 44, whereupon the cycle of operation is complete. It will be obvious that the turns that the spring is wound will depend upon the number of revolutions of the shaft 2 necessary to move the fingers 38 out of engagement with the stops 41 after the trigger 25 has engaged the plate 13. Furthermore, it will be seen that even if the operating rod 64 be arrested in an intermedi-

ate position, no damage can be done, inasmuch as the trigger 25 and the winding limiting means 51 are carried by the same shaft. If the trigger 25 is not engaged it makes no difference that the finger 56 is out of engagement, since the whole winding drum will rotate freely, while if the trigger 25 be engaged the finger 56 will also be operating and the winding will necessarily be limited.

At its forward end the shaft 2 is provided with stops 70 adapted to receive a crank of the usual kind, since if the engine fails to start upon the first impulse it is necessary to turn it over by hand, since the starting device will have become exhausted. A cap 71 is preferably secured to the end of the casing so as to cover the end of the shaft, and its loss is prevented by the chain 72.

Owing to the fact that the pawl and ratchet device 19 and 21, shown in Fig. 3, is liable to be somewhat noisy, it may be preferable in some cases to employ the ball clutch illustrated in Fig. 5, in which the unwinding plate 13^a is illustrated as having an annular recess 20^a formed with spaced inclined notches 73 having therein balls or rollers 74 adapted to grip the cylindrical surface of the plate 19^a which serves in lieu of the ratchet 19. The casing, however, is intended to be partly filled with oil, which will be found to deaden the noise to a great degree, in addition to its lubricating qualities.

It will be noted that the rewinding of the spring does not take place immediately, but is slightly delayed so as to allow the engine to gather enough speed so as not to be killed by the load so imposed upon it.

While I have necessarily described my invention in detail, I do not propose to be limited to such details except as the same may be positively included in the claims hereto annexed or may be rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:

1. In a starting device for explosion engines, the combination, with a shaft adapted to be connected to the engine shaft and a support in which said shaft is journaled, of a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the storage of potential energy of rotation, means for connecting said unwinding plate to said shaft so as to drive the same in one direction, a trigger carried by said support and governing the operation of said unwinding plate, means carried by said support and preventing retrograde rotation of said winding plate, a clutch device carried by said shaft and adapted to engage said winding plate, and means carried by said support and operated simultaneously with said trigger for disengaging said clutch and

winding plate at a predetermined number of turns after the engagement of said unwinding plate by said trigger.

2. In a starting device for explosion engines, the combination, with a shaft connected to the engine shaft, and a support in which said shaft is journaled, of a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the storage of potential energy of rotation, means for connecting said unwinding plate to said shaft so as to drive the same in one direction, a trigger carried by said support and governing the operation of said unwinding plate, means carried by said support and preventing retrograde rotation of said winding plate, a clutch device carried by said shaft and adapted to engage said winding plate, means for holding said clutch away from said winding plate during the operation of said unwinding plate, and means carried by said support and operated simultaneously with said trigger for disengaging said clutch and winding plate at a predetermined number of turns after the engagement of said unwinding plate by said trigger.

3. In a starting device for explosion engines, the combination, with a shaft adapted to be connected to the engine shaft and a support in which said shaft is journaled, of a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the storage of potential energy of rotation, means for connecting said unwinding plate to said shaft so as to drive the same in one direction, means carried by said support and engaging said winding plate to prevent rotation thereof in the opposite direction, a clutch device carried by said shaft and adapted to engage said winding plate, means for releasing said unwinding plate to give an initial rotation to said shaft and for locking said unwinding plate against further forward rotation after such impulse, means for causing said clutch to engage said winding plate between said time of releasing and locking, and means for disengaging said clutch a predetermined number of turns after said locking.

4. In a starting device for explosion engines, in combination, an unwinding plate adapted to be connected in driving relation to the engine shaft, a winding plate, means connecting said plates and adapted for the storage of potential energy of rotation, a shaft adapted to be driven by the rotation of said engine, a clutch device on said shaft and adapted to engage said winding plate, means for locking said unwinding plate against operation, means for normally holding said clutch device out of engagement with said winding plate, means operative after the release of said unwinding plate for causing said clutch device to engage said

winding plate, means operative after the engagement of said clutch device for relocking said unwinding plate, and means operative at a predetermined number of turns after the relocking of said unwinding plate to cause said clutch to disengage said winding plate.

5. In a starting device for explosion engines, the combination, with a shaft connected in driving relation with the engine shaft and a support in which said shaft is journaled, of a winding plate sleeved upon said shaft, means whereby the forward rotation of said plate may be caused to store up potential energy of rotation, means whereby said potential energy can be released to cause an initial rotation of said shaft, a clutch member slidably but non-rotatably mounted on said shaft and adapted to engage said winding plate, a spring tending to project said clutch into such engagement, means normally holding said clutch out of engagement against the tension of said spring, the body of said clutch being formed with a helical groove, means for releasing said holding means after the release of the potential energy to permit said clutch to engage said winding plate, and a finger adapted to engage said groove to draw said clutch out of its engagement after a predetermined number of rotations.

6. In a starting device for explosion engines, the combination, with a shaft operatively connected to the engine shaft and a support in which said shaft is journaled, of a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the storage of potential energy of rotation, a one-way clutch for connecting said unwinding plate to said shaft, a rock shaft carried by said support parallel to said first shaft, a trigger carried by said rock shaft and adapted to engage said unwinding plate, means carried by said support and engaging said winding plate to prevent retrograde rotation thereof, a clutch carried by said first shaft and adapted to engage said winding plate, a spring tending to project said clutch into such engagement, an arm carried by said rock shaft for holding said clutch out of engagement against the tension of said spring and for releasing said clutch simultaneously with releasing said unwinding plate, means for holding said clutch out of engagement during the operation of said unwinding plate, means for releasing said clutch and permitting its engagement with the winding plate immediately after the relocking of the unwinding plate, and means for disengaging said clutch from said winding plate after a predetermined number of revolutions thereof relative to said unwinding plate.

7. In a starting device for explosion en-

gines, the combination, with a shaft operatively connected to the engine shaft and a support in which said shaft is journaled, of a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the storage of potential energy of rotation, a one-way clutch for connecting said unwinding plate to said shaft, a rock shaft carried by said support parallel to said first shaft, a trigger carried by said rock shaft and adapted to engage said unwinding plate, means carried by said support and engaging said winding plate to prevent retrograde rotation thereof, a clutch slidably carried by said first shaft and adapted to engage said winding plate, said clutch having an external helical groove, a spring tending to project said clutch into such engagement, an arm carried by said rock shaft for holding said clutch out of engagement against the tension of said spring and for releasing said clutch simultaneously with releasing said unwinding plate, means for holding said clutch out of engagement during the operation of said unwinding plate, and means for releasing said clutch and permitting its engagement with the winding plate immediately after the relocking of the unwinding plate, said arm having a finger adapted to engage said helical groove for disengaging said clutch from said winding plate after a predetermined number of revolutions thereof relative to said unwinding plate.

8. In a starting device for explosion engines, in combination, a torsion device adapted to store up potential energy for giving an initial impulse to the engine shaft, a winding plate adapted to be rotated to store up such energy, a shaft driven by the engine shaft and having a clutch member thereon adapted to engage said winding plate, means for retaining said clutch in inoperative position and for disengaging said clutch simultaneously with the liberation of said energy to start the engine, separate means for engaging said clutch member to hold it in inoperative position upon the release of said first means and for disengaging said clutch prior to the reengagement of said first means therewith, and means for reengaging said clutch simultaneously with the reengagement of said energy storing means and for disengaging said clutch from said winding plate after a predetermined number of revolutions thereof.

9. In a starting device for explosion engines, the combination, with a shaft connected to the engine shaft, of a pair of independently rotatable plates sleeved upon said shaft, a support in which said shaft is journaled, means connecting said plates and adapted for the storage of potential energy of rotation, means for connecting one of

said plates to said shaft in driving relation, means for arresting the forward rotation of said plate, means for preventing the rearward rotation of the other of said plates, a
 5 clutch member slidably but non-rotatably sleeved upon said shaft and adapted to engage said other plate, means for releasing said first plate, means for retaining said
 10 clutch member out of engagement with said plate during the normal operation of the engine, and during the operation of said engine by said first plate, means permitting the engagement of said clutch member and said other plate after the operation of said
 15 first plate, and means for separating said clutch member and plate at a predetermined time after the relocking of said mechanism.

10. In a starting device for explosion engines, in combination, a spring adapted to
 20 have potential energy of revolution stored therein, an unwinding plate adapted to transmit the energy of said spring to the engine shaft, means for locking said plate against operation, a winding plate by means
 25 of which energy can be again stored in said spring, a shaft rotatable by said engine shaft and associated with said winding plate, a clutch member slidably but non-rotatably
 30 mounted upon said shaft and having a helical groove in its exterior face and having means adapted to engage said winding plate, a spring adapted to project said clutch into engagement with said winding plate, and an
 35 arm adapted to engage said groove for drawing said clutch member away from said winding plate after a predetermined amount of winding of said spring.

11. In a starting device for explosion engines, the combination, with a shaft operatively connected to the engine shaft and a
 40 support in which said shaft is journaled, of

a winding and an unwinding plate independently sleeved upon said shaft, means connecting said plates and adapted for the
 45 storage of potential energy of rotation, a one-way clutch for connecting said unwinding plate to said shaft, a rock shaft carried by said support parallel to said first shaft, a trigger carried by said rock shaft and
 50 adapted to engage said unwinding plate, means carried by said support and engaging said winding plate to prevent retrograde rotation thereof, a clutch slidably carried by said first shaft and adapted to engage said
 55 winding plate, said clutch having an external helical groove, a spring tending to project said clutch into such engagement, an arm slidably mounted on said rock shaft for holding said clutch out of engagement against the tension of said spring and for
 60 releasing said clutch simultaneously with releasing said unwinding plate, a spring associated with said arm and acting to slide the same therealong in a direction away from said winding plate, means for holding
 65 said clutch out of engagement during the operation of said unwinding plate, and means for releasing said clutch and permitting its engagement with the winding plate immediately after the relocking of the un-
 70 winding plate, said arm having a finger adapted to engage said helical groove for disengaging said clutch from said winding plate after a predetermined number of revolutions thereof relative to said unwinding
 75 plate.

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

WEBESTER F. TRAVES.

Witnesses:

HAROLD E. SMITH,
 BRENNAN B. WEST.