No. 895,328. PATENTED AUG. 4, 1908.

H. C. BAILEY.

STARTING DEVICE FOR EXPLOSION ENGINES.

APPLICATION FILED MAY 18, 1907. 3 SHEETS—SHEET 1.

Fig. 1.

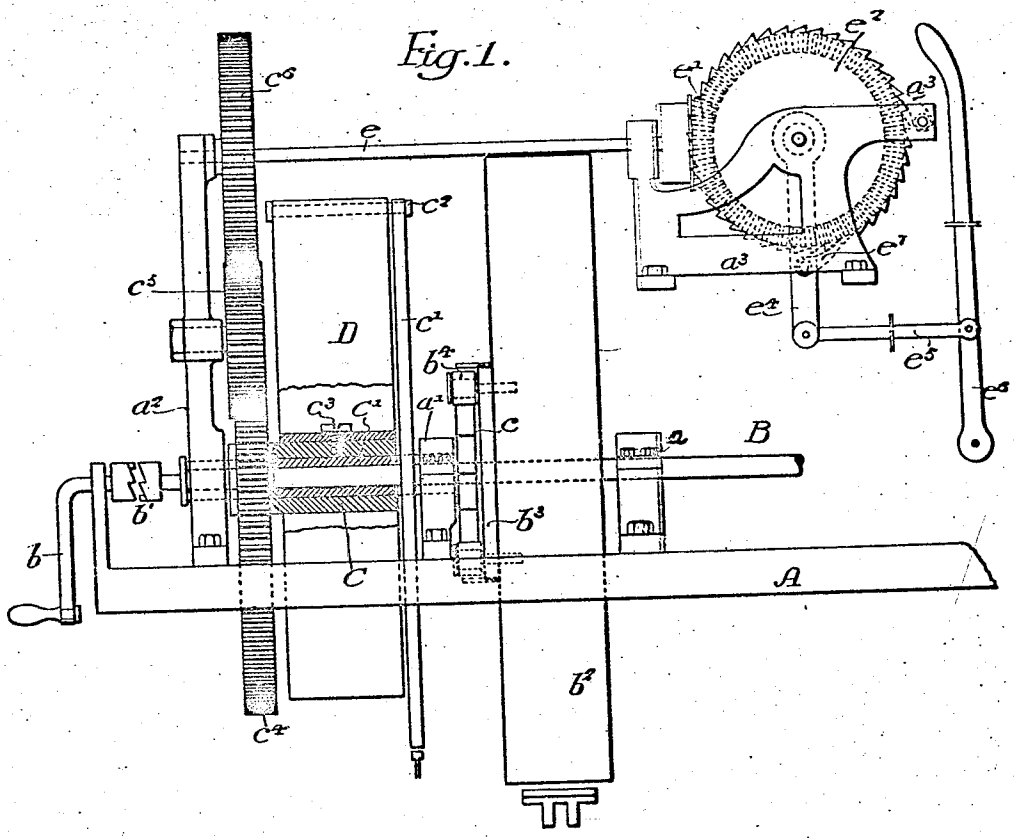

Fig. 2.

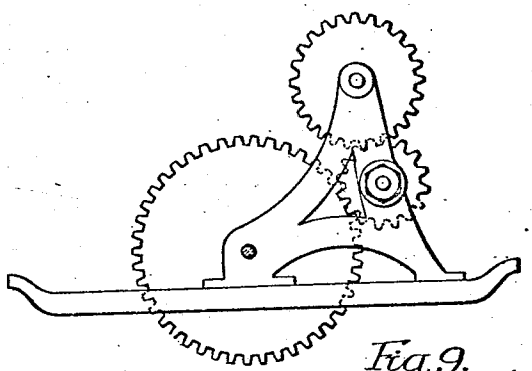

Fig. 3.

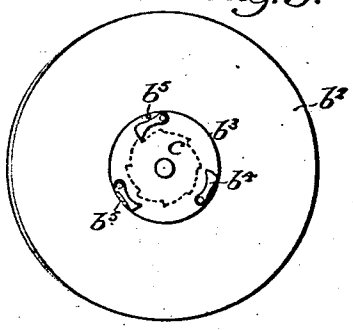

Fig. 9.

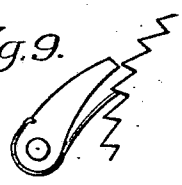

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Fig. 2.

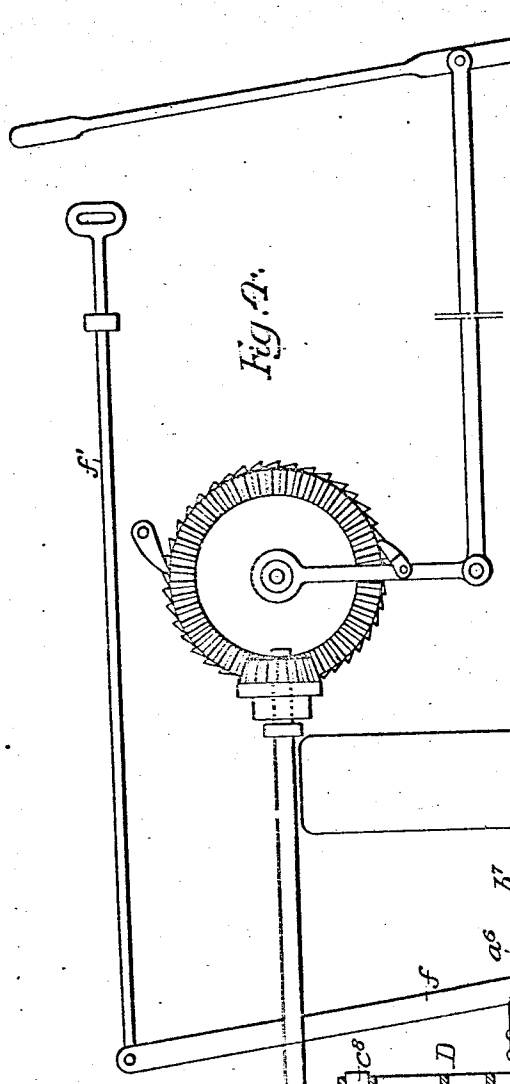
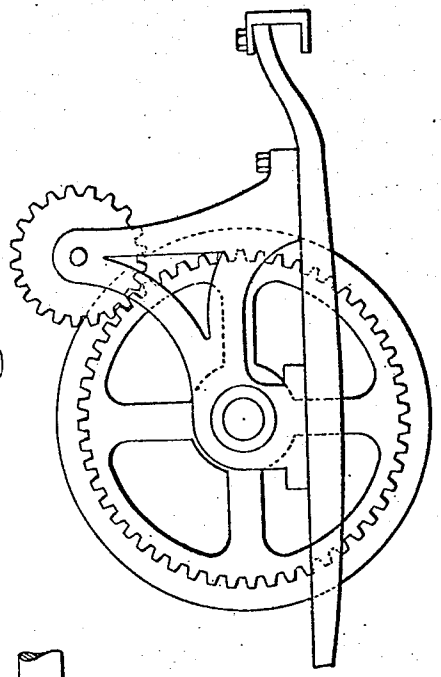


Fig. 5.



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APPLICATION FILED MAY 18, 1907. 3 SHEETS—SHEET 3.

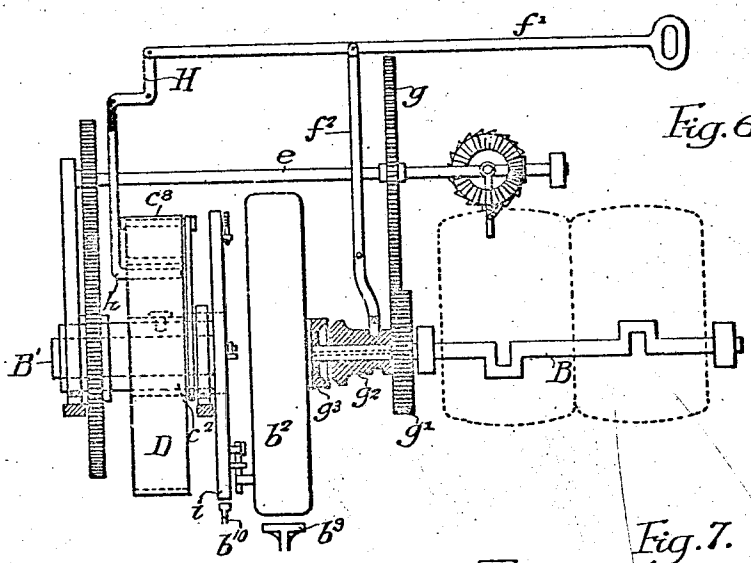


Fig. 6.

Fig. 7.

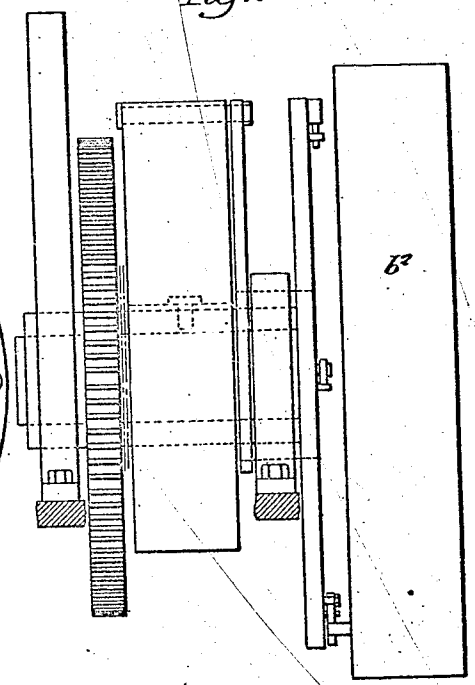
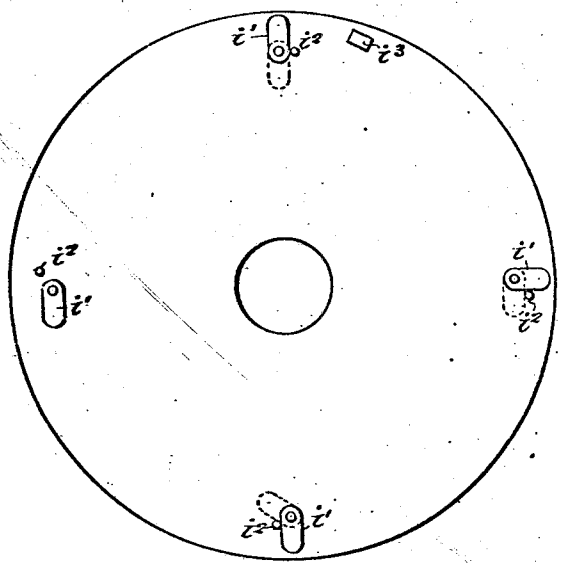


Fig. 8.



Witnesses:-
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UNITED STATES PATENT OFFICE.

HOWARD C. BAILEY, OF PHILADELPHIA, PENNSYLVANIA.

STARTING DEVICE FOR EXPLOSION-ENGINES.

No. 895,328. Specification of Letters Patent. Patented Aug. 4, 1908.

Application filed May 18, 1907. Serial No. 374,508.

To all whom it may concern:

Be it known that I, HOWARD C. BAILEY, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Starting Devices for Explosion-Engines, of which the following is a specification.

One object of my invention is to provide a device of a simple and compact nature whereby an explosive engine, such as may be used to propel motor vehicles, may be given the few preliminary revolutions necessary to start it, with the expenditure of but relatively little physical energy on the part of the operator.

It is further desired to provide a device of the general character above noted, which may be conveniently operated from the driver's seat of a motor vehicle and which will be automatically disconnected from the engine mechanism as soon as the engine is started.

Another object of the invention is to provide a starting device for an explosive engine of such a nature that its actuating spring may be wound up by the engine itself after this has once been started; being automatically disconnected from the engine after the winding has proceeded to a predetermined extent.

The above and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1, is a side elevation to some extent diagrammatical and partly in section, illustrating the apparatus comprising one form of my invention; Fig. 2, is an end elevation of a portion of the gearing employed in the apparatus shown in Fig. 1; Fig. 3, is a side elevation of the fly wheel and the automatic clutch carried thereby; Fig. 4, is a side elevation illustrating a form of my invention in which a hand operated clutch is employed in place of the automatic clutch; Fig. 5, is an end elevation of a por ion of the gearing used in connection with the apparatus shown in Fig. 4; Fig. 6, is a side elevation illustrating a form of my invention in which the starting spring may be wound either by hand or by engine power; Fig. 7, is a side elevation on a larger scale than that of Fig. 6, illustrating certain detail features of my invention; Fig. 8, is a side elevation illustrating a special form of clutch which may be employed in connection with my invention, and Fig. 9, is a side elevation illustrating a form of pawl controlling device preferably employed by me.

In Figs. 1 to 3 of the above drawings, A represents a supporting frame work upon which are mounted bearings a, a' and a bracket a^2. Said bearings and brackets serve as means of support for an extension of the main shaft B of the explosion engine, which it is desired to start by my invention, and this shaft is provided at one end with the ordinary starting crank b and a clutch b' whereby said crank may be connected at will to said shaft.

The fly wheel of the engine is indicated at b^2 and has fixed to one end of its hub a plate b^3 on which are mounted three pawls b^4 limited as to their movement by pins or other suitable forms of stops b^5.

Upon the engine shaft are mounted two sleeves C and C', the latter of which has rigidly fixed to it a ratchet wheel c mounted upon it adjacent to the plate b^3 on the fly wheel so as to be capable of being engaged by the pawls b^4. It also has fixed to it a radially extending arm c'. A relatively heavy metallic spring D has its outer end connected to a pin c^2 projecting from the arm c' and has its inner end connected with the sleeve C by means of a screw c^3.

A gear wheel c^4 is rigidly keyed or otherwise fixed to the sleeve C and is connected through an intermediate gear c^5 to a gear c^6 fixed on the shaft e. This latter shaft is mounted in bearings on the bracket a^2 and in a frame a^3, in any desired manner. The shaft e carries at its end a beveled pinion e' meshing with the teeth of a bevel gear e^2 mounted upon a suitable spindle carried on the frame a^3; this gear being provided with ratchet teeth at its periphery and having a holding pawl e^3. Loosely mounted upon the shaft or spindle for this gear, is an oscillatory arm e^4 connected through a link e^5 to a hand lever e^6.

With the above described arrangement of parts the oscillation of the hand lever e^6 on its pivot causes a similar movement of the arm e^4 and as this is provided with a pawl e^7 which engages the ratchet teeth of the gear e^2, this latter is intermittently turned.

It will be noted, however, that when it is desired to start the engine, the brake mechanism is first set, or some other means, such a holding device, is provided for temporarily preventing the revolution of the engine

shaft B. Consequently as the shaft e is turned by the oscillation of the lever e^6, the spring D is wound, since the movement of said shaft is transmitted through the gears c^6, c^7 and c^4 to the sleeve C. Since the engine shaft is held, the arm c' cannot be turned under the action of the spring because one or more of the pawls b^4 are naturally engaged with the teeth of the ratchet c. After the spring has been wound to a predetermined point, and the various devices connected with the engine mechanism properly set, this latter may be started by suddenly releasing the brake mechanism, when the spring D will unwind, giving the few preliminary revolutions to the engine shaft ordinarily required to cause the engine to start.

It is obvious that when the engine becomes self-actuating, its speed almost instantly rises to a point in excess of that of the ratchet wheel c which is turned by the spring D, even if said wheel has not already come to rest, and in any case the speed of the engine is sufficient to cause the pawls b^4 to move out of engagement of the ratchet wheel c and to be held out of such engagement under the action of centrifugal force as long as the engine operates. When, however, the engine is stopped, one or more of the pawls will fall, under the action of gravity, into engagement with the ratchet teeth, so that the device is again ready to be started.

The device forming the subject of my invention is usually employed in the starting of explosion engines used in motor vehicles and under these conditions the operating lever e^6 is placed adjacent to the driver's seat. As a consequence, the engine may be more easily started than with the well known crank, although as illustrated in Fig. 1 this is usually provided for use in emergencies. Inasmuch as the work of winding the spring is performed at a relatively low rate, it will be understood that the apparatus is very easy to operate.

If desired, I may arrange the various parts as illustrated in Figs. 4 and 5, in which case the gear c^5 may be omitted, while the gear c^4 is mounted upon a sleeve C^2 carrying a plate c^7. This latter plate is connected through a pin c^8 with the outer end of the spring D, while the inner end of this latter is connected through a sleeve C^3 with the movable member b^6 of a clutch. The other member b^7 of the clutch is rigidly fixed to the fly wheel b^2, while a lever f pivoted to any suitable support, is connected to the movable clutch member which, by means of a hand bar f', may be shifted into and out of engagement with the other clutch member. The intermediate bearing a' not only tends to support the sleeve C^3 but has fixed to it a spring a^6 of flat material formed at its outer ends so as to fit into an annular groove in the clutch member a^6 and thereby hold said member away from the clutch member on the fly wheel. In this case, I provide a brake b^9 for holding the fly wheel from revolution during the time in which the spring D is being wound and it is obvious that when the engine is operating under normal conditions, this brake is released and the clutch member b^6 is held away from the clutch member b^7 by means of the spring a^6.

When it is desired to start the engine, the hand rod f' is moved so as to throw the two clutch members b^6 and b^7 into engagement and the brake shoe b^9 is applied to the fly wheel. The spring is then wound as previously described, and in order to give the engine the few preliminary revolutions necessary, the brake b^9 is suddenly released, when the unwinding of the spring turns the fly wheel and through it revolves the main shaft of the engine. As soon as this is driven by its own power, the increased speed of the fly wheel and of the clutch member b^7 causes the clutch member b^6 to be moved outward so that said parts are automatically disconnected; the spring a^6 serving to retain the member b^6 in its disconnected position.

In Figs. 6, 7, and 8, my device is illustrated as so arranged that the spring D may, when desired, be wound by hand or may be connected to the engine after this has been started, so that it performs the work of winding said spring. In such case the shaft e has fixed to it another gear wheel g and this meshes with a gear g' fixed to a movable clutch member g^2 loose on the engine shaft. The second member g^3 of this clutch is fixed to the shaft B and the parts are so arranged that the hand bar f' may, through a lever f^2, cause the movable clutch member g^2 to be coupled to the engine shaft of the clutch member g^3. Under these conditions it is obvious that the winding shaft e will be driven from the engine shaft and will consequently wind the spring D. In order that such winding may not proceed beyond a predetermined point, I provide a bell crank lever H having one arm h so arranged as to be acted on by one of the convolutions of the spring D; its other arm being connected through the hand bar f' to the lever f^2. With this arrangement, when the spring D is wound to a predetermined point, it causes the turning of the lever H upon its pivot and such a movement of the hand bar as will then connect the clutch members g^2 and g^3.

In order to operatively connect the spring D with the main shaft, I may employ either of the devices shown in Figs. 1 and 4, or such a clutch as that illustrated in Figs. 7 and 8. In the latter case, the sleeve C^2 has extended through it a shaft section B' carrying adjacent to the fly wheel b^2, a plate i connected to the outer end of the spring D by means of a pin c^8. This plate, as shown in Fig. 8, has mounted upon it a number of swinging fin-

gers i' each provided with a stop i^2 whereby their revolution is prevented beyond a certain point. Upon the adjacent face of the fly wheel b^2, I mount a projecting stud i^3 and it is obvious that when the engine shaft is being turned by the spring D, said stud is engaged by one of the fingers i' so that power is transmitted from the spring to the fly wheel through said finger and its stop i^2. When, however, the engine is moved by its own power, the fingers i' are either held out of the way of the stop i^2 by gravity, or, as shown in Fig. 8, turned over by it so as to rest against the stops i^2 out of the way. When, however, the engine is stopped and the plate i again turned under the action of the spring D, when this begins to be wound, the fly wheel, through said stud, is again coupled to the said spring as before described.

In winding the spring by hand, I may employ, if desired, a brake shoe b^9 operative on the fly wheel, and when such winding is done by means of the engine, a brake b^{10} is applied to the plate i so as to hold this from turning independently of the fly wheel. The brake shoe b^{10} may also be used in conjunction with my winding lever attachment independently of the automatic winding system, for the driver may throw on said brake shoe while the engine is running and wind up the spring through the medium of the hand lever, thus holding said spring in condition for instant starting of the engine after its next stop.

In starting high power engines in which there is great compression to be overcome in giving the few preliminary revolutions, I may use a series of compression relief cocks operative from the driver's seat so as to be instantly closed on the first series of explosions of the engine.

I claim:

1. A starting device for internal combustion engines, consisting of a spring, a ratchet wheel connected to one end of the spring, means attached to the opposite end of the spring for winding the same, with a rotatable supporting body connected to the engine and having a pawl or pawls placed to be capable of engaging the teeth of the ratchet wheel, said pawls being placed to disengage said teeth and remain in disconnected positions under the action of centrifugal force when the speed of the engine exceeds that of the ratchet wheel, substantially as described

2. The combination of an engine shaft, two sleeves mounted thereon, one within the other, a spring having one of its ends attached to one of the sleeves and its other end attached to the other sleeve, a ratchet wheel fixed to one of the sleeves and a gear wheel fixed to the othe sleeve, a structure connected to the engine shaft provided with pawls capable of engaging the ratchet wheel, and means for turning the gear wheel to wind up the spring, substantially as described.

3. The combination of an engine shaft, two sleeves mounted thereon, one within the other, a spring having one of its ends attached to one of the sleeves and its other end attached to the other sleeve, a ratchet wheel fixed to one of the sleeves and a gear wheel fixed to the other sleeve, a structure connected to the engine shaft provided with pawls capable of engaging the ratchet wheel, and means for turning the gear wheel to wind up the spring, said means including an auxiliary shaft having a gear meshing with said first gear, a ratchet wheel connected to said auxiliary shaft, and a lever carrying a pawl for periodically turning said second ratchet wheel, substantially as described.

4. A device for starting explosive engines consisting of a shaft, a structure thereon provided with a plurality of pawls pivoted to it, a ratchet wheel placed to be engaged by said pawls, an arm connected to said ratchet wheel, a sleeve mounted on the engine shaft, a spring having its inner end connected to said sleeve and its outer end connected to the arm, with hand operated mechanism for turning said sleeve to wind up the spring, substantially as described.

5. The combination of an engine shaft, a sleeve thereon, a spring having one end connected to the sleeve, a clutch having one member connected to the engine shaft and the other to the second end of the spring, means for winding said spring including a gear wheel connected to the said sleeve, an auxiliary shaft having a second gear meshing with said first gear, a beveled pinion on the auxiliary shaft, a ratchet wheel having beveled teeth meshing with the said beveled pinion, a pawl for preventing movement of the ratchet wheel in one direction, a lever carrying a second pawl operative upon the ratchet wheel, and a hand lever connected to said first lever, for oscillating the same, substantially as described.

6. The combination in a starting device for an explosive engine, of an engine shaft having one member of a clutch, a second clutch member capable of being connected to the first clutch member, a spring having one end connected to the second clutch member, gearing operatively connected to the other end of said spring, and hand operated means for actuating said gearing to wind the spring, said clutch being constructed to automatically disconnect the engine from the spring when the speed of the shaft exceeds that of the clutch member attached to the spring, and including means whereby its members are maintained disconnected, substantially as described.

7. In a starting device for explosive engines, the combination with the engine of an auxiliary shaft, a spring having one end operatively connected thereto, a clutch having one member connected to the other end of the spring and its second member connected to the engine shaft, a hand operated device for winding the spring having mechanism connecting it with the auxiliary shaft, and auxiliary mechanism also connected to the auxiliary shaft whereby the latter may be connected at will with the engine shaft to wind the spring by power, substantially as described.

8. The combination in a starting device for explosive engines, of an engine shaft, an auxiliary shaft independent of the engine shaft, a spring having one end operatively connected to said auxiliary shaft, a clutch having one member operatively connected to the second end of the spring and its second member connected to the engine shaft, means for winding the spring by hand, and mechanism for connecting at will said engine shaft with the auxiliary shaft for winding the spring by power, substantially as described.

9. The combination in a starting device for explosive engines, of an engine shaft, an auxiliary shaft, a spring having one end operatively connected to said auxiliary shaft, a clutch having one end operatively connected to the second end of the spring and its second member connected to the engine shaft, mechanism for connecting at will said engine shaft with the auxiliary shaft for winding the spring by power, means for winding the spring by hand, and means for automatically disconnecting the engine shaft and the auxiliary shaft when the spring has been wound to a predetermined extent, substantially as described.

10. The combination in a starting device for explosive engines, of an engine shaft, an auxiliary shaft, a spring having one end connected to said auxiliary shaft, means for connecting the other end of the spring to the engine shaft under predetermined conditions, mechanism for driving the auxiliary shaft from the engine shaft including a clutch, and a second clutch interposed between the spring and the engine shaft capable of automatically disconnecting said two parts when the engine shaft reaches a predetermined speed, with auxiliary hand operated means for winding the spring, substantially as described.

11. In a starting device for explosive engines, the combination with an engine shaft, of a clutch having one member connected to said shaft, an auxiliary shaft, means for connecting said auxiliary shaft to the other member of the clutch, means for connecting or disconnecting said clutch members at will, a spring connected to the auxiliary shaft, a device operated by the spring for automatically disconnecting the clutch members under predetermined conditions, and means for driving the engine shaft from the spring until the speed of the shaft reaches a predetermined point, substantially as described.

12. In a starting device for explosive engines, the combination with the engine shaft, of a clutch having one member connected to said shaft, an auxiliary shaft, means for connecting said auxiliary shaft to the other member of the clutch, means for connecting or disconnecting said clutch members at will, a spring connected to the auxiliary shaft, a device operated by the spring for automatically disconnecting the clutch members under predetermined conditions, and automatic clutch mechanism between the spring and the shaft constructed to maintain said two parts in operative connection as long as the speed of the engine shaft is below a predetermined point, substantially as described.

13. In a starting device for explosive engines, the combination of an engine shaft, a spring, means for driving the engine shaft from the spring, a clutch having one member connected to the engine shaft and the other loose thereon, means for winding said spring including a shaft driven from said loose member of the clutch when said member is connected to the engine shaft, a hand operated device for actuating the spring winding shaft, and hand operated means for actuating said clutch, substantially as described.

14. In a starting device for explosive engines, the combination of an engine shaft, a spring, means for driving the engine shaft from the spring, a clutch having one member connected to the engine shaft and the other loose thereon, means for winding said spring including a shaft driven from said loose member of the clutch when said member is connected to the engine shaft, a hand operated device for actuating the spring winding shaft, with hand operated and automatic means for actuating said clutch, substantially as described.

15. In a starting device for gas engines, the combination of an engine shaft, a clutch having one member connected to said shaft, a winding shaft connected to the second member of the clutch, a spring capable of being wound by said driving shaft, means for actuating the engine shaft from the spring, said means being arranged to automatically disconnect said parts when the engine shaft turns at a predetermined speed, and means for operating the clutch, substantially as described.

16. In a device for starting explosive engines, the combination of an engine shaft, a clutch having one member connected thereto, a gear wheel connected to the second member of the clutch and loose on the engine shaft, a winding shaft having a gear meshing with said first gear, hand operated means for

turning said winding shaft, a spring connected thereto, means for connecting the winding shaft and the auxiliary shaft, a structure connected to the spring having means whereby it is connected to the engine shaft only so long as the speed of the engine shaft is less than the speed of said structure, with a hand operated device for operating said clutch, substantially as described.

17. In a starting device for explosive engines, the combination of an engine shaft, a clutch having one member connected thereto, a gear wheel connected to the second member of the clutch and loose on the engine shaft, a winding shaft having a gear meshing with the said first gear, hand operated means for turning said winding shaft, a spring connected thereto, means for connecting the winding shaft with the auxiliary shaft, a structure connected to the spring having means whereby it is connected to the engine shaft only so long as the speed of the engine shaft is less than the speed of said structure, with a hand operated device for operating said clutch, and means controlled by the spring for automatically actuating the clutch, substantially as described.

18. The combination of an engine shaft, a spring, a clutch capable of operatively connecting one end of the spring with the said shaft, and means operative independently of the engine mechanism attached to the other end of the spring for winding the same by a succession of intermittent impulses, substantially as described.

19. The combination of an engine shaft, a spring, a clutch capable of operatively connecting one end of the spring with the said shaft, and constructed to automatically disconnect said parts when the speed of the shaft exceeds a predetermined amount, and hand operated means connected to the other end of the spring, the said means being constructed to intermittently deliver a series of turning impulses to wind the spring independently of the engine shaft, substantially as described.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

HOWARD C. BAILEY.

Witnesses:
WM. E. SHUPE,
JOS. H. KLEIN.