F. C. HAYES.

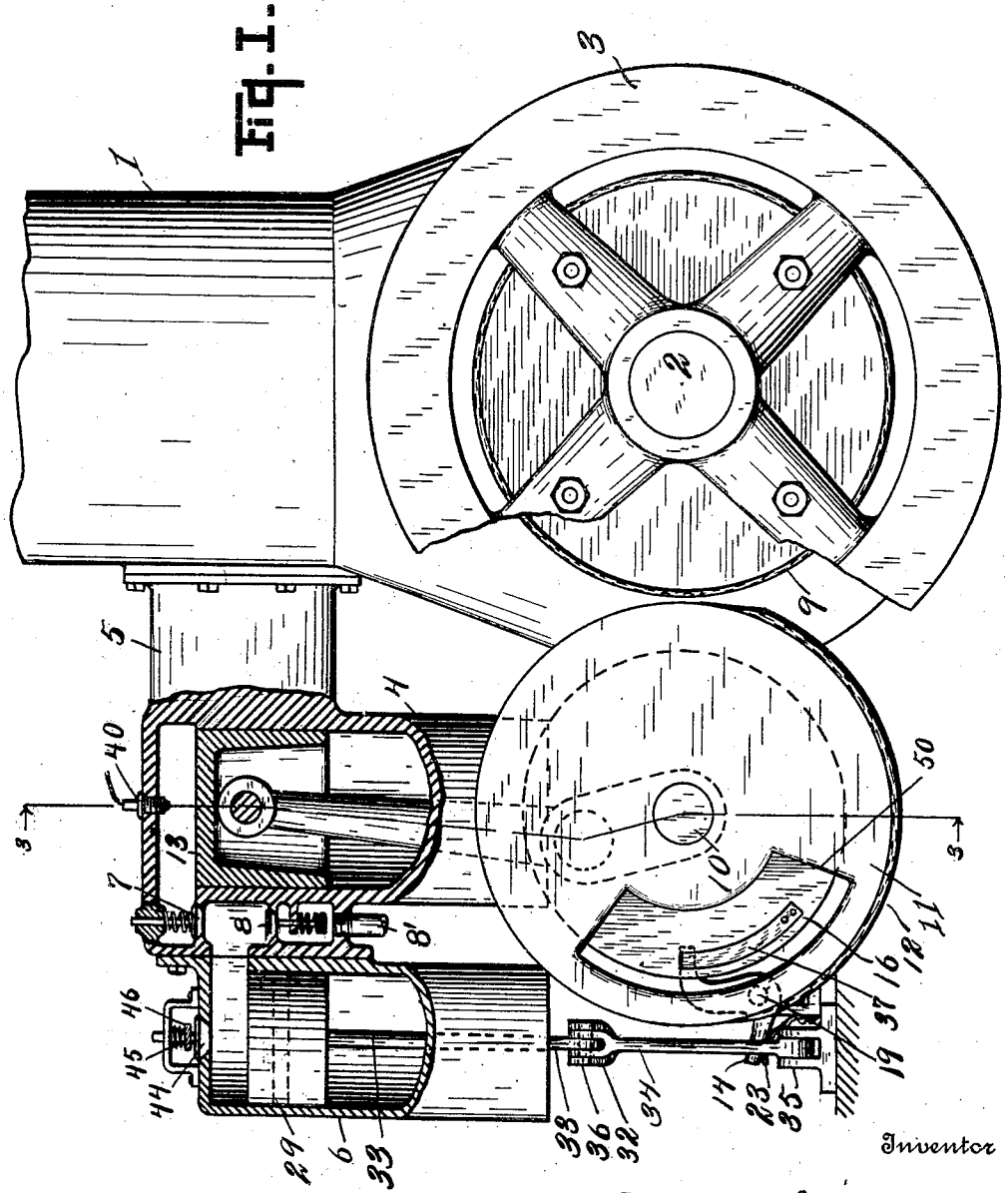
STARTING DEVICE FOR EXPLOSION ENGINES.

APPLICATION FILED SEPT. 18, 1911.

1,039,127. Patented Sept. 24, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Margaret Glasgow.

M. Phina Woodruff.

Inventor

Frederick C. Hayes

By Chappell & Earle

Attorneys

F. C. HAYES.

STARTING DEVICE FOR EXPLOSION ENGINES.

APPLICATION FILED SEPT. 18, 1911.

1,039,127. Patented Sept. 24, 1912.

3 SHEETS—SHEET 2.

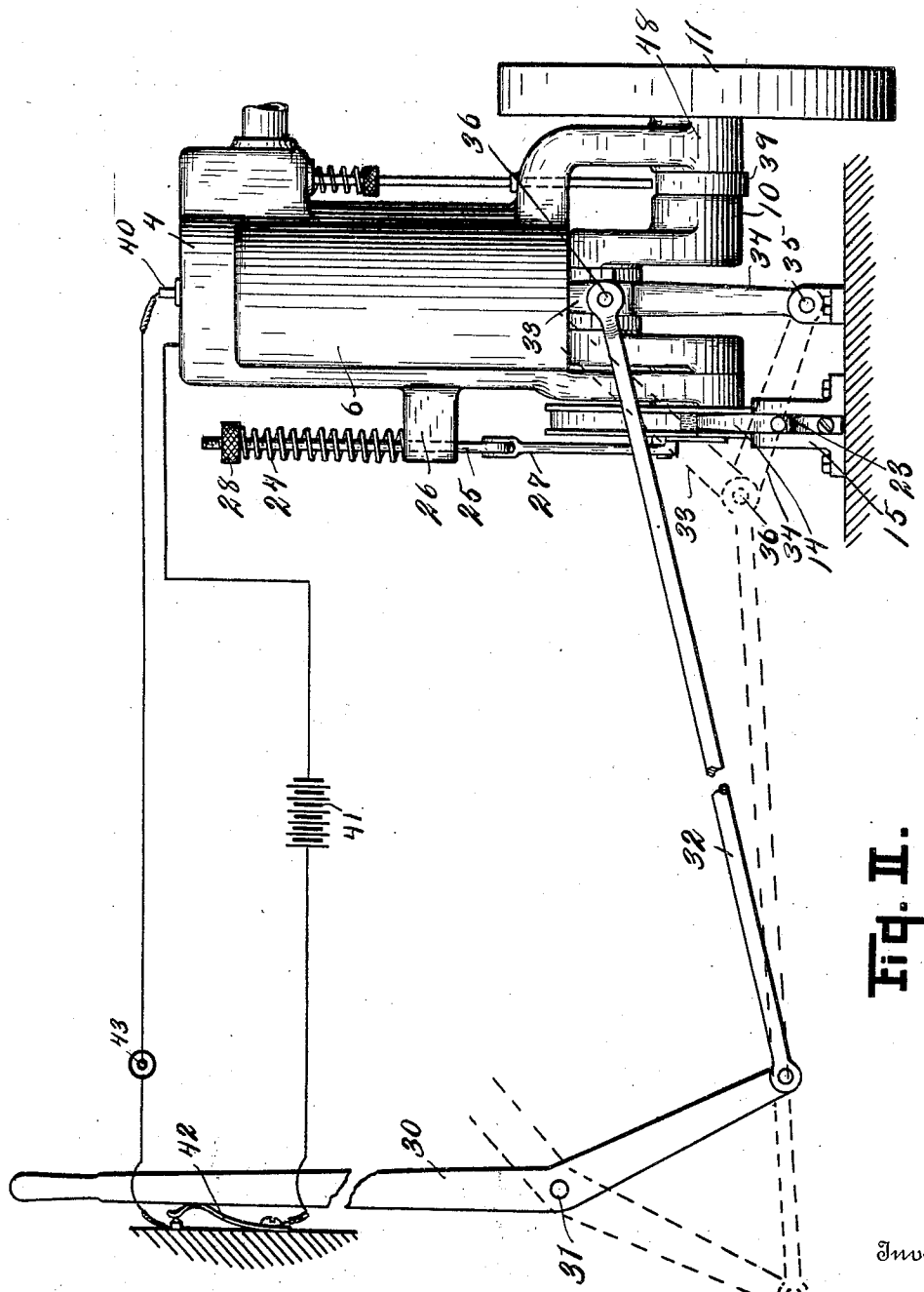


Fig. II.

Witnesses

Margaret Glasgow.

M. Olivia Woodruff.

Inventor

Frederick C. Hayes.

By Chappell & Earl.

Attorneys

F. C. HAYES.

STARTING DEVICE FOR EXPLOSION ENGINES.

APPLICATION FILED SEPT. 18, 1911.

1,039,127.

Patented Sept. 24, 1912.

3 SHEETS—SHEET 3.

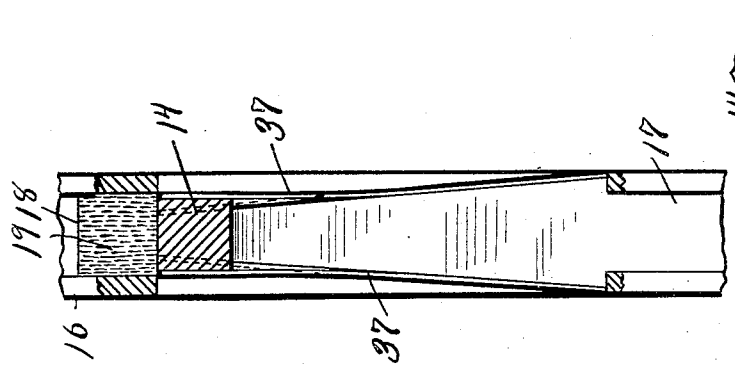


Fig. VI.

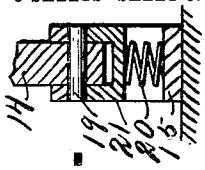


Fig. VII.

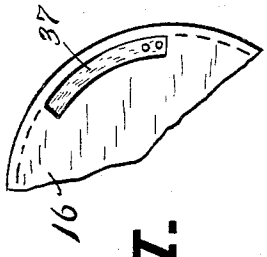


Fig. V.

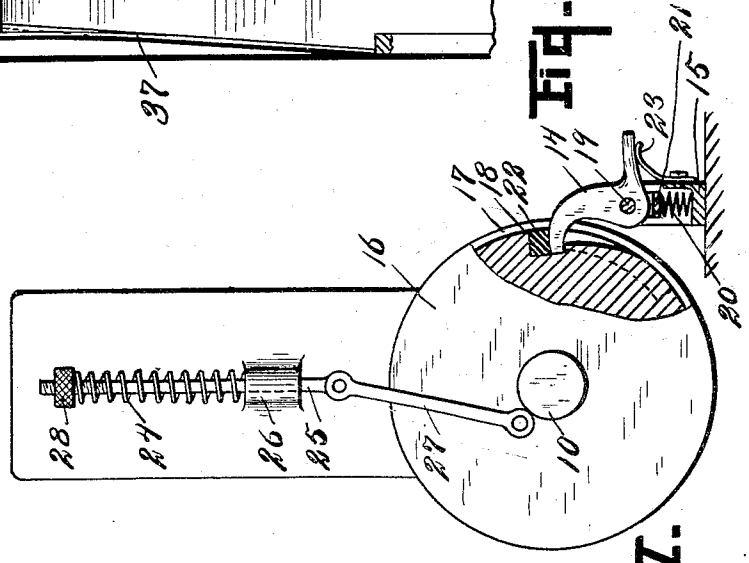


Fig. IV.

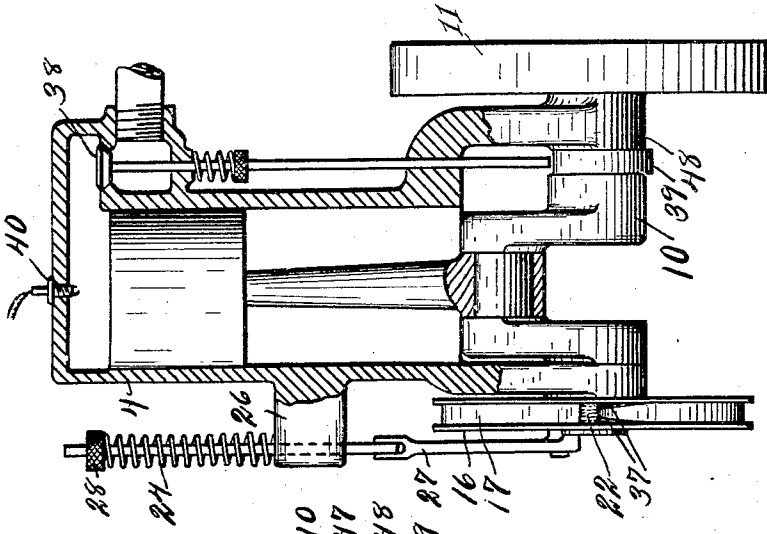


Fig. III.

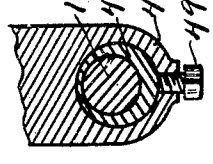


Fig. VIII.

Witnesses

Margaret Glasgow.

M. Shna Woodruff.

Inventor

Frederick C. Hayes

By Chappell Hearn

Attorneys

UNITED STATES PATENT OFFICE.

FREDERICK C. HAYES, OF BATTLE CREEK, MICHIGAN.

STARTING DEVICE FOR EXPLOSION-ENGINES.

1,039,127. Specification of Letters Patent. Patented Sept. 24, 1912.

Application filed September 18, 1911. Serial No. 649,996.

To all whom it may concern:

Be it known that I, FREDERICK C. HAYES, a citizen of the United States, residing at the city of Battle Creek, county of Calhoun, and State of Michigan, have invented certain new and useful Improvements in Starting Devices for Explosion-Engines, of which the following is a specification.

This invention relates to improvements in starting devices for explosion engines.

The main objects of this invention are, first, to provide an improved starting device for explosion engines which is effective for the purpose and very easily manipulated. Second, to provide an improved starting device for explosion engines comprising a starting motor in which the starting motor may be charged with fuel such as is used for the engine, the charging being effected through a pump. Third, to provide in an apparatus of the class described, an improved driving connection for the starting motor and the engine to be started. Fourth, to provide an apparatus of the class described, which is comparatively simple in structure and operation and not likely to get out of repair.

Further objects, and objects relating to structural details, will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed out in the claims.

A structure which is a preferred embodiment of my invention is clearly illustrated in the accompanying drawing, forming a part of this specification, in which:

Figure I is a detail side elevation of a structure embodying the features of my invention, the starting motor cylinder and the pump cylinder being shown in vertical section. Fig. II is a detail elevation view looking from the left of Fig. I, the certain parts being conventionally illustrated. Fig. III is a detail vertical section taken on a line corresponding to the broken line 3—3 of Fig. I. Fig. IV is a detail view looking from the left of Fig. III, showing the means for returning and locking the starting engine in its initial position. Fig. V is a detail side elevation of the locking disk 16, showing the arrangement of the springs 37 thereon. Fig. VI is an enlarged detail view of the disk 16. Fig. VII is a detail vertical section of the locking dog 14 and its support. Fig. VIII is a detail vertical section showing the adjustable bearing for the shaft 10.

In the drawing, similar reference characters refer to similar parts throughout the several views, and the sectional views are taken looking in the direction of the little arrows at the ends of the section lines.

Referring to the drawing, 1 represents the engine to be started, 2 the crank shaft thereof, and 3 the fly wheel on the crank shaft. The cylinder 4 of the starting motor or engine is, in the structure illustrated, provided with a bracket 5 which is bolted to the side of the engine 1. The charging pump cylinder 6 is mounted on the cylinder 4 and connected therewith through the inlet valve 7. The inlet valve being of the puppet type, its details are not further described. The pump is provided with a check intake valve 8, the pipe 8′ being connected to a suitable fuel supply such as the carbureter, not illustrated, of the engine 1. The crank shaft 2 of the engine 1 is provided with a friction wheel 9, while the crank shaft 10 of the starting motor is provided with a friction wheel 11 having a segmental friction surface 12 adapted to coact with the friction wheel 9. The friction wheel 9, is in the structure illustrated, bolted to the fly wheel 3. The friction member or wheel 11 is adapted to serve as the fly wheel. The friction surface 12 of the fly wheel or friction member 11 of the starting motor being segmental, acts on the friction wheel 9 or driven member 1 during a portion only of the revolution of the starting motor crank shaft 10.

The piston 13 of the starting motor is locked in its initial position, that is at the end of its outstroke, in which position, the driving members 9 and 11 are disconnected (see Fig. I). The locking means preferably comprises a locking dog 14, mounted on the bracket 15 to coact with the disk 16 on the crank shaft 10. The disk 16 has a peripheral groove 17 therein, adapted to receive the dog 14. The disk 16 is provided at one side with a notch-like keeper 18 for the dog 14. This keeper 18 is located in a groove of the disk so that the dog 14 drops into it on each revolution of the disk or on each cycle of the starting motor. The pivot 19 for the dog is preferably supported by the spring 20 which engages the pivot block 21 (see Figs. IV and VII). This arrangement is provided to relieve the parts of shock when

the dog or lock engages. A buffer 22 is preferably provided for the keeper to further relieve the engaging shock. The dog is held yieldingly in its engaging position by the spring 23. To insure the returning of the piston 13 to its initial position, I provide a return spring 24 which is arranged on the plunger rod 25 which reciprocates in the boss 26 on the side of the cylinder 4. The rod is connected with the disk 16 by means of a link 27. The upper end of the rod is provided with a nut 28 which may be adjusted to regulate the tension of the spring. The pump piston 29 is actuated from the lever 30 which is pivoted at 31 and connected by the link 32 to the pump piston rod 33, and the link 34. The link 34 being pivoted at 35 and connected to the piston rod by the pivot 36, and the lever connecting link 32 being mounted on the pivot 36. I secure a toggle actuating means for the pump, the piston rod being one member of the toggle. By this simple means, I am able to charge the starting cylinder with comparatively little effort.

The dog 14 is arranged to be released by the pump actuating toggle (see Figs. I and II). When the dog 14 is disengaged, the springs 37 prevent its reëngaging until the disk 16 is rotated. These springs are secured to the sides of the disk as shown in Figs. V and VI, and converge forwardly into the keeper. When the disk is rotated, the dog traveling in the groove, moves into the keeper between the springs. The exhaust valve 38 is held open by the cam 39 on the shaft 10 to discharge the exhaust and also to permit the piston 13 being easily returned to its initial position.

The ignition system comprises a suitable spark plug, as 40, connected to a suitable source of electrical supply as the battery 41. In the circuit of the system illustrated, is a spring switch 42 which is adapted to automatically open when the lever 30 is actuated to charge the pump. This prevents the ignition of the starting motor until after the pump lever 30 is returned to its initial or normal position. A switch 43 is provided in the circuit for controlling the igniting of the charge.

To prevent over-charging of the starting cylinder, I provide the pump with a pressure release valve 44. This valve is provided with a tension spring 45 regulated by the adjusting nut 46. If the pump should be actuated after the starting cylinder is properly charged, this release valve opens. To secure the desired driving friction between the driven member 9 and the driving member 11, I preferably support the shaft 10 in the eccentric bearings 47, which can be rotated in the boxing 48 to swing the wheel 11 to or from the wheel 9. A set screw 49 is provided for retaining the bearing in its adjusted position. In order that the starting piston may not be stopped with the piston rod and crank shaft on the dead center, as might occur in the event of a light charge, and to assist the spring 24, I counterbalance the crank shaft as by providing the wheel 11 with an opening 50 on one side. It is obvious that the same effect would be secured by adding a weight to the opposite side. The segmental friction surface 12 is so disposed that it is disengaged at the time the piston rod passes the dead center on the out-stroke of the piston, so that the weight has merely to carry the parts past the center and the spring will return them to the normal or initial position. Further, the engine can be provided with the ordinary starting crank, if desired, and manipulated therefrom, with return means, for the starting engine or motor will always be out of engagement when the starting motor is not being used, and it will always be in position for use.

My improved starting apparatus is comparatively simple and economical in structure, and is very easily operated. The parts are not likely to be injured in use owing to the automatically connecting and disconnecting driving connections for the engine and starting motor. A friction driving connection is preferred by me, as this permits some slippage so that the parts are in a measure relieved from the shock to which they would otherwise be subjected.

I have illustrated and described my improved starting apparatus in detail in a simple and effective embodiment thereof. I have not attempted to illustrate or describe the various modifications in structural details which are possible, as I believe the disclosure made will enable those skilled in the art to which this invention relates to apply the same as taste or circumstances may dictate.

I desire to be understood as claiming my improvements specifically in the form illustrated, as well as broadly within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination with a driven shaft, of a starting motor; a crank shaft therefor; a friction wheel on said crank shaft having a segmental friction surface coacting with the friction wheel of said driven shaft; a fuel pump for said cylinder; means for actuating said pump comprising an actuating lever and toggle, the pump piston rod being one member of the toggle; means for locking said motor comprising a catch dog and a coacting disk mounted on said crank shaft and having a peripheral groove provided with a notch-like keeper for said dog, and a pair of springs secured to the sides of

said disk to swing into the notch when the dog is withdrawn therefrom, said dog being positioned to be released by said pump actuating toggle; a pressure release valve for said pump; means for returning the parts to their initial position comprising a spring, a plunger rod actuated by said spring, and a link connecting said rod to said disk; an exhaust valve actuating cam on said crank shaft positioned to open the exhaust valve during the return of the parts to their initial position; and an ignition system comprising circuit connections having a spring switch which is closed by the pump actuating lever when in its normal position.

2. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor provided with a crank shaft; a friction member on said crank shaft arranged to engage said friction wheel only during the partial revolution of said crank shaft; means for automatically locking said crank shaft on each revolution thereof with said friction member thereof out of engagement with said friction wheel on said driven shaft; a pump for charging said motor; means for actuating said pump adapted to release said lock; an ignition system for said motor comprising a circuit switch adapted to automatically open on the actuation of the pump actuating means; a pressure release valve for said pump; a spring for returning said crank shaft to its initial position; an exhaust valve for said motor; and a cam on said crank shaft for opening said exhaust valve during the return of the parts to their initial position.

3. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor provided with a crank shaft; a friction member on said crank shaft arranged to engage said friction wheel only during the partial revolution of said crank shaft; means for automatically locking said crank on each revolution thereof with said friction member thereof out of engagement with said friction wheel on said driven shaft; a pump for charging said motor; means for actuating said pump adapted to release said lock; an ignition system for said motor comprising a circuit switch adapted to automatically open on the actuation of the pump actuating means; and a pressure release valve for said pump.

4. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor provided with a crank shaft; a friction member on said crank shaft arranged to engage said friction wheel only during the partial revolution of said crank shaft; means for automatically locking said crank shaft on each revolution thereof with said friction member thereof out of engagement with said friction wheel on said driven shaft; a pump for charging said motor; means for actuating said pump adapted to release said lock; a pressure release valve for said pump; a spring for returning said crank shaft to its initial position; an exhaust valve for said motor; and a cam on said crank shaft for opening said exhaust valve during the return of the parts to their initial position.

5. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor provided with a crank shaft; a friction member on said crank shaft arranged to engage said friction wheel only during the partial revolution of said crank shaft; means for automatically locking said crank shaft on each revolution thereof with said friction member thereof out of engagement with said friction wheel on said driven shaft; a pump for charging said motor; means for actuating said pump adapted to release said lock; and a pressure release valve for said pump.

6. In a structure of the class described, the combination with the crank shaft of the engine to be started, of a friction wheel on said crank shaft; a starting motor; a crank shaft therefor; a friction wheel on said starting motor crank shaft provided with a segmental friction surface coacting with said friction wheel on said engine shaft; means for returning said starting motor to is initial position, comprising a spring, said crank shaft being counterweighted to coact with said spring in carrying the crank shaft past the dead center, said friction surface being out of engagement when such point is passed and means for automatically locking said starting motor crank shaft on each revolution thereof with the friction surface on its friction wheel out of engagement with said friction wheel on said engine crank shaft.

7. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor; a crank shaft therefor; a friction member on said motor crank shaft provided with a segmental friction surface coacting with said friction wheel on said driven shaft; means for automatically locking said motor crank shaft on each revolution thereof, with said friction member out of engagement with said friction wheel; and actuating means for said motor comprising a charging mechanism adapted when actuated to release said lock.

8. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor; a crank shaft therefor; and a friction member on said motor crank shaft pro-

vided with a segmental friction surface coacting with said friction wheel on said driven shaft and means for returning said starting motor to its initial position, comprising a spring, said crank shaft being counter-weighted to coact with said spring in carrying the crank shaft past the dead center, said friction surface being out of engagement when such point is passed.

9. In a structure of the class described, the combination of a driven friction wheel; a motor provided with a crank shaft; and a friction member on said motor crank shaft provided with a segmental friction surface coacting with said driven friction wheel and means for returning said starting motor to its initial position, comprising a spring, said crank shaft being counter-weighted to coact with said spring in carrying the crank shaft past the dead center, said friction surface being out of engagement when such point is passed.

10. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impulse of the starting motor; means for automatically locking said starting motor in its initial position in which position the driving connections therefor to said crank shaft are disconnected; a pump for charging the motor; means for actuating said charging pump adapted to release said lock; a spring for returning the parts of the motor piston to its initial position; and an ignition system for the motor comprising a switch member, said switch member being retained in its closed position by the pump actuating means.

11. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impulse of the starting motor; means for automatically locking said starting motor in its initial position in which position the driving connections therefor to said crank shaft are disconnected; a pump for charging the motor; means for actuating said charging pump adapted to release said lock; and a spring for returning the parts of the motor piston to its initial position.

12. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impulse of the starting motor; means for automatically locking said starting motor in its initial position in which position the said driving connections are disconnected; and means for charging the starting motor adapted to release said lock.

13. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impulse of the starting motor; and means for automatically locking said starting motor in its initial position in which position the said driving connections are disconnected.

14. The combination with the driven member, of a motor; driving connections for said motor and driven member adapted to automatically engage and disengage on each actuation of the motor; a fuel pump for said motor; a toggle actuating means therefor; a spring for returning the motor piston to its initial position; means for locking the motor in its initial position, comprising a dog and a rotary disk having a peripheral groove adapted to receive said dog, the groove of said disk being provided with a notch-like keeper, and a pair of converging springs secured to the sides of said disk to swing into said notch when the dog is withdrawn therefrom, said dog being positioned to be released by said pump actuating toggle.

15. The combination with the driven member, of a motor; driving connections for said motor and driven member adapted to automatically engage and disengage on each actuation of the motor; means for locking said motor in its initial position, comprising a dog and a rotary disk having a peripheral groove adapted to receive said dog, the groove of said disk being provided with a notch-like keeper, and a pair of converging springs secured to the sides of said disk to swing into said notch when the dog is withdrawn therefrom.

16. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impulse of the starting motor; means for automatically locking said starting motor in its initial position in which position the driving connections therefor to said crank shaft are disconnected, comprising a dog and a rotary disk having a notch-like keeper for said dog, and a spring adapted to swing into said keeper when said dog is withdrawn therefrom.

17. In a structure of the class described, the combination with the engine to be started, of a starting motor; driving connections for said starting motor to said engine adapted to automatically connect and disconnect on each impluse of the starting motor; means for automatically locking said starting motor in its initial position

in which position the driving connections therefor to said crank shaft are disconnected, comprising a dog and a rotary disk having a notch-like keeper for said dog.

18. The combination with the driven member of a motor; driving connections for said motor and driven member adapted to automatically engage and disengage on each actuation of the motor; a fuel pump for charging said motor; actuating means therefor; means for locking said motor in its initial position adapted to be released by said pump actuating means; and an ignition system for said motor comprising a switch, said switch being adapted to automatically open when said pump actuating means is moved from its normal position.

19. The combination with the driven member of a motor; driving connections for said motor and driven member adapted to automatically engage and disengage on each actuation of the motor; means for locking said driving connections in their disengaged relation; a fuel pump for charging said motor; actuating means therefor; adapted to release said locking means and an ignition system for said motor comprising a switch, said switch being adapted to automatically open when said pump actuating means is moved from its normal position.

20. The combination with the driven member of a motor; driving connections for said motor and driven member adapted to automatically engage and disengage on each actuation of the motor; a fuel pump for charging said motor; actuating means therefor; and means for locking said motor in its initial position adapted to be released by said pump actuating means.

21. In a structure of the class described, the combination with the driven shaft, of a friction wheel on said driven shaft; a motor; a crank shaft therefor; a friction member on said crank shaft provided with a segmental friction surface coacting with said friction wheel on said driven shaft; means for automatically locking said motor shaft on each revolution thereof with said friction member out of engagement with said friction wheel; a spring for returning the motor crank shaft to its initial position, said crank shaft being counterweighed to coact with said spring in carrying the crank shaft past the dead center, said friction surface being out of engagement when such point is passed.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

FREDERICK C. HAYES. [L. S.]

Witnesses:

LUELLA G. GREENFIELD,

MARGARET L. GLASGOW.