

H. F. BENNETT.
 STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED AUG. 30, 1913.

1,099,685.

Patented June 9, 1914.

2 SHEETS—SHEET 1.

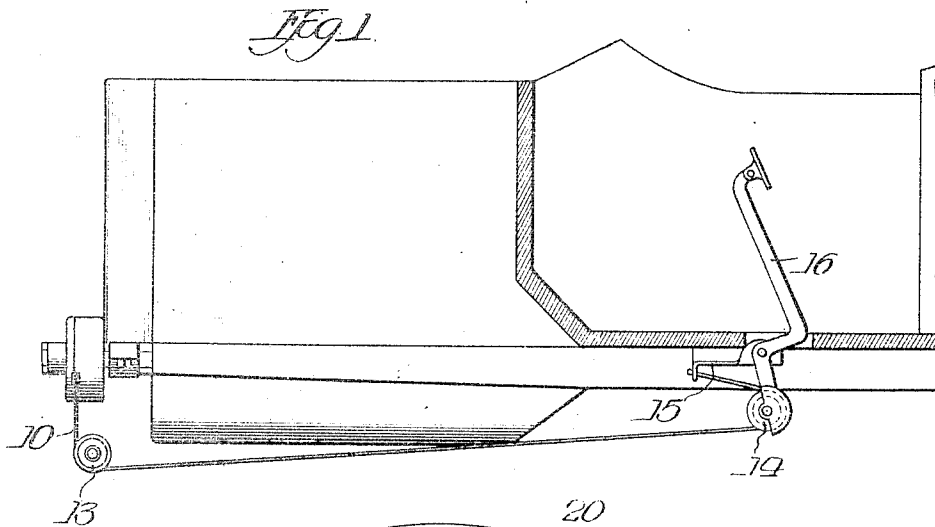
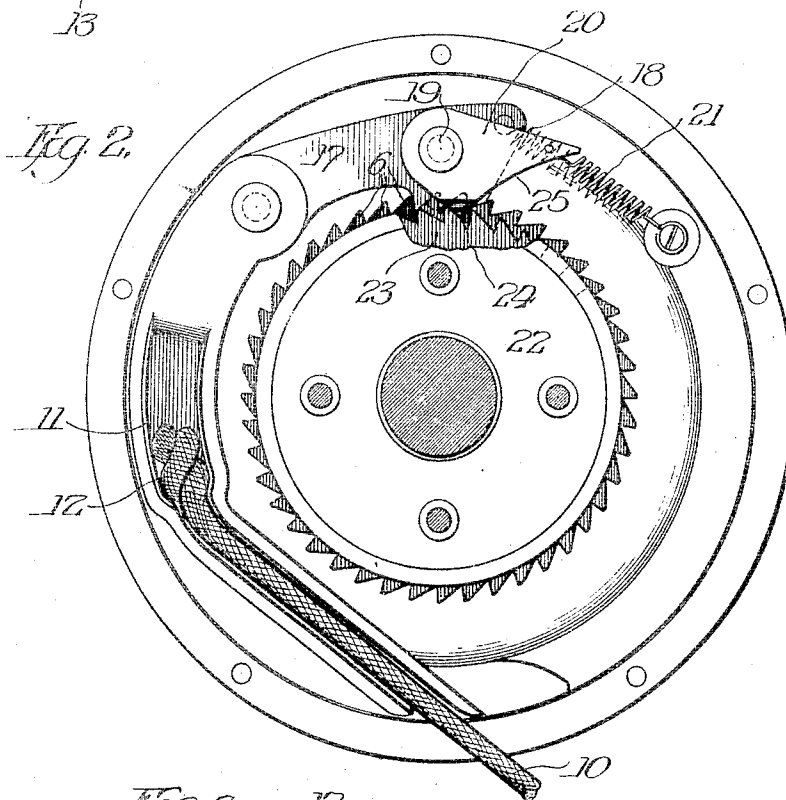


Fig. 3

Witnesses:
Ed. C. Brown
William Young

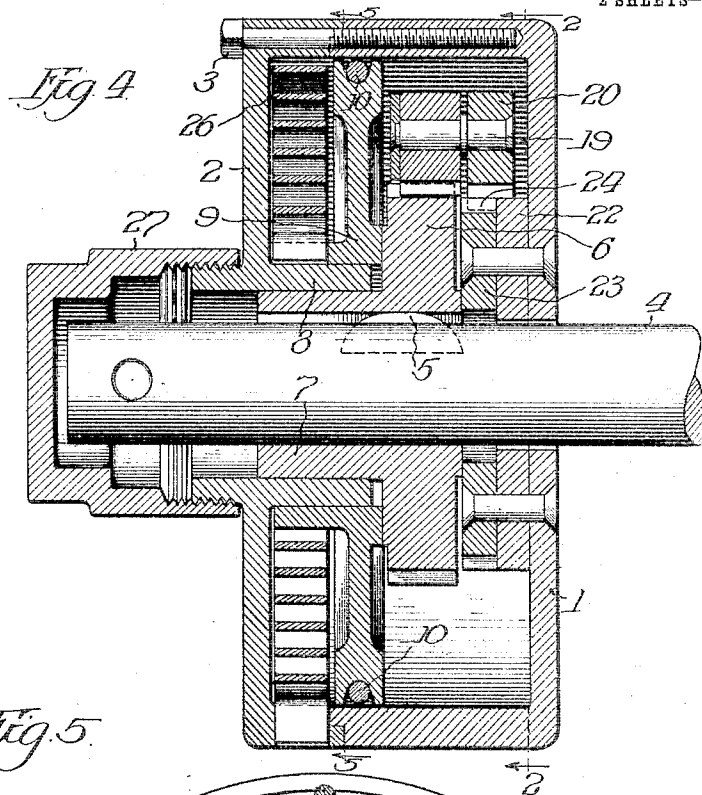
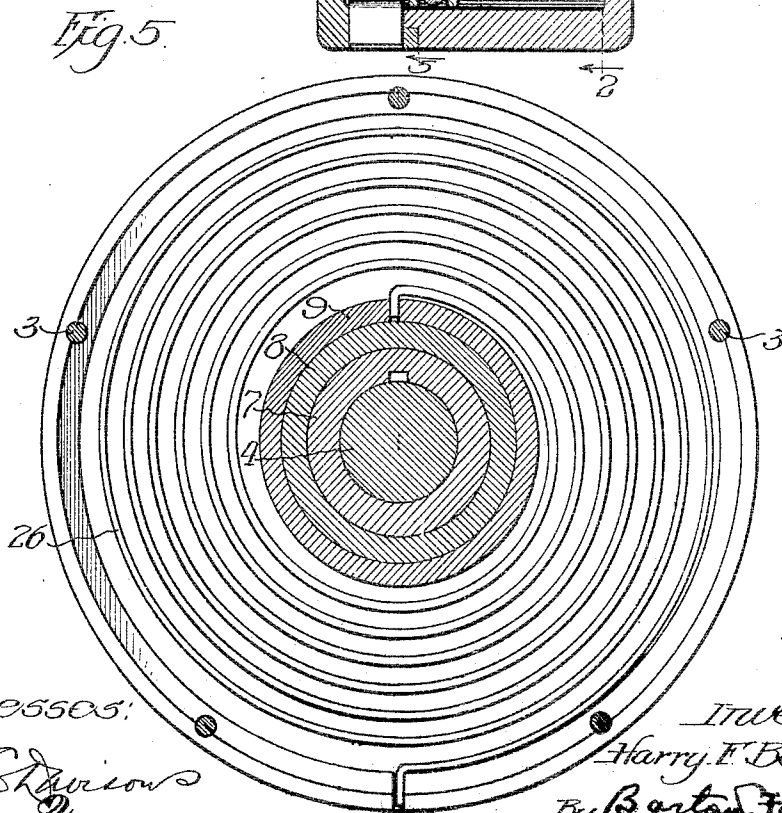
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,099,685.

Specification of Letters Patent.

Patented June 9, 1914.

Application filed August 30, 1913. Serial No. 787,448.

To all whom it may concern:

Be it known that I, HARRY F. BENNETT, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Starting Devices for Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description.

My invention relates to a starting device for internal combustion engines and is particularly designed to be applied to automobiles or the like so that the engine thereof may be started by the driver while remaining in his seat.

One of the objects of my invention is to provide a starting device which will automatically release itself from the engine-shaft in case of back-fire of the engine.

Another object is to provide a starting device which is normally held out of operative position and is automatically thrown into-operative position at the beginning of the starting stroke.

Another object is to provide a starting device in which the operating pawl is thrown out of engagement with the operating ratchet during the return movement of the pawl, thereby preventing injury in case the engine back-fires during the return movement of the pawl.

Still another object is, in general, to provide a device which is simple in construction, positive in operation and which can readily be substituted for the hand-operated crank commonly utilized for starting automobile engines.

My invention may be more readily understood by reference to the accompanying drawings, showing the preferred embodiment thereof, and in which—

Figure 1 is a side elevation of the apparatus applied to an automobile; Fig. 2 is a section on the line 2—2 of Fig. 4, showing the driving pawl in operative relation with the ratchet with which it cooperates; Fig. 3 is a fragmentary view similar to Fig. 2 showing the normal or inoperative position of the driving pawl with respect to the ratchet; Fig. 4 is a central, longitudinal section of the device; and Fig. 5 is a section on the line 5—5 of Fig. 4.

Similar letters of reference refer to similar parts throughout the several views.

As above stated, the starter of my inven-

tion is designed to be substituted for the ordinary hand-operated crank, such crank being removed and the starter attached to the main shaft at the front of the car, as indicated in Fig. 1. The rear portion 1 of the cylindrical casing of the starter is rigidly secured to the car-body in any suitable manner, such rear portion of the casing being cup-shaped, as indicated most clearly in Fig. 4. The front portion or cover 2 of the casing is secured to the rear portion by a series of screw-bolts 3. Secured to the engine shaft 4 by a key 5 or in other suitable manner is a ratchet wheel 6 having a sleeve portion 7 which fits within an annular hub portion 8 which extends inwardly from the center of the cover 2. The sleeve 7 of the ratchet wheel 6 and the shaft 4 thus rotate within the fixed hub 8 of the cover 2. Journaled upon the hub 8 adjacent the ratchet wheel 6 is an operating or starting wheel 9, the circumference of which is grooved to receive a rope or cable 10, one end of which, as indicated in Fig. 2, is secured to the wheel 9 in any suitable manner, as for example by a groove 11 having an enlarged portion for receiving the knot 12 in the end of the cable, and a restricted portion extending from said enlarged groove to the grooved circumference of said wheel. Said cable extends through an opening in the casing of the starter over a guide-pulley 13 and a tightening-pulley 14, the opposite end of the cable being secured to a bracket 15 upon the under side of the car-body as indicated in Fig. 1. The pulley 14 is carried upon the lower end of a foot lever or pedal 16, the upper end of which extends into convenient position for the driver of the automobile to operate the same by foot-pressure and thereby to pull upon the cable 10. It is obvious, therefore, that by pressing down upon the pedal 16 a turning movement may be imparted to the wheel 9 and the cable unwound therefrom and said wheel turned to the position indicated in Fig. 2.

I will next describe the means whereby the turning of the starting wheel 9 in the manner just described operates to turn the main shaft 4 of the engine in starting the latter. Pivoted upon the side of the wheel 9 adjacent the ratchet wheel 6 is a starting pawl 17, which engages with the teeth of the ratchet wheel 6. A spring 18 secured to the end of the pawl 17 tends to hold said pawl

in engagement with the teeth of the ratchet wheel 6, the operative position of said pawl and ratchet wheel being shown in Fig. 2. With the pawl in such engagement with the teeth of the ratchet wheel 6, it is obvious that a pull upon the cable 10, produced by depressing the pedal 16 in the manner just described, imparts a rotary motion to the engine shaft 4 upon which said ratchet wheel 6 is keyed, for the purpose of starting the engine.

I will next describe the means by which the pawl 17 is held out of operative relation with the ratchet 6 while the engine is running or is thrown out of operative relation in case of back-fire of the engine. Pivoted upon the free end of the pawl 17 by means of the pivot pin 19, is a kick-out pawl or dog 20. A spring 21 tends to hold said kick-out dog in the position shown in Fig. 2. Coöperating with the kick-out dog 20 is a fixed ratchet wheel 23 and preferably also a fixed disk 22, both rigidly secured upon the inside of the casing 1, (see Fig. 4). Extending from one corner of the under portion of the kick-out dog 20 is a tooth 24, which, during the starting movement, that is during the time that the pawl 17 is acting upon the ratchet 6 to turn the latter, rides over the teeth of the ratchet 23, the teeth of the latter being inclined in a direction opposite to the inclination of the teeth of the ratchet 6, as shown in Fig. 2. During the return stroke of the driving pawl 17, the pawl 17 rides over the teeth of the ratchet 6, thus lifting said pawl 17 and the dog 20 carried thereby. Likewise the tooth 24 of the dog 20 engages the abrupt face of a tooth of the ratchet wheel 23 and thus the dog 20 is thrown to the position shown in Fig. 3 and it remains therein until a further forward movement is given to the dog 17. It will be noted that the end of the dog 20 has a curved surface 25 corresponding to the curvature of the disk 22 and ratchet wheel 23 and that the said dog 20 is of a thickness sufficient to overlap both said disk and ratchet wheel, as is clearly shown in Fig. 4. Thus, during the running of the engine, the grooved portion 25 of the dog 20 rests upon the fixed disk 22 and ratchet wheel 23, as shown in Fig. 3, the pawl 17 being held out of engagement with the teeth of the ratchet wheel 6. The fixed disk 22 thus provides a running surface for the curved end of the dog 20, thereby reducing the wear upon the teeth of the ratchet 23. It also prevents the extreme forward end of the dog 25 from being accidentally, by reason of a sudden actuation of the parts, thrown into engagement with the teeth of the fixed ratchet wheel 23. Fig. 3 thus illustrates the position of the parts during the running of the engine, in which position it remains after the engine is

stopped and until the starting movement is imparted to the starter through the foot-pedal 16. Upon such starting movement being given, the pawl 17 is immediately thrown into engagement with the ratchet wheel 6, that is to say, the parts are moved from the position shown in Fig. 3 to that shown in Fig. 2. With the parts in the position shown in Fig. 3, if the wheel 9 be turned in the direction to start the engine, that is, in a contra-clockwise direction, the dog 20 is turned to the position shown in Fig. 2, thereby permitting the pawl 17 to be drawn by the spring 18 into engagement with the teeth of the ratchet wheel 6.

It is obvious that in case of back-fire during the starting of the engine, the parts will be immediately moved from the position shown in Fig. 2 to that shown in Fig. 3. That is to say, if a reverse rotation be given to the ratchet wheel 6 which would tend to reversely rotate the wheel 9, thereupon the tooth 24 of the kick-out dog 20 will engage the abrupt face of one of the teeth of the ratchet wheel 23, turning said kick-out dog against the tension of its spring 21 and thereby lifting the pawl 17. In short, by reason of such back-fire, the driving pawl and the kick-out dog assume the position shown in Fig. 3. Therefore, on premature explosion of the engine, no injurious action occurs and instead of the pedal kicking back, it continues its stroke though it is automatically released from its driving connection with the main shaft while the shaft or ratchet is rotating.

For the purpose of effecting the return stroke of the starting pawl 17, I provide the spring 26 (see Figs. 4 and 5), the coils of which surround each other. The inner end of the spring 26 is secured to the hub of the wheel 9 and the outer end thereof to the cover 2 of the casing. Thus, as the cable is pulled out by operating the pedal 16, power is stored in the spring 26 to return the wheel 9 and to rewind the cable 10 about said wheel.

If for any reason it be desired to crank the engine manually, this can be done by unscrewing the cap 27 and attaching the ordinary crank-handle to the end of the shaft 4 in the usual manner.

What I claim is:—

1. A starting device for internal combustion engines comprising, in combination with the engine shaft, a ratchet wheel secured to said shaft; an operating member loosely mounted concentric with said ratchet wheel; a starting pawl pivoted at one end to said operating member and coöperating with said ratchet wheel to drive the latter; a kick-out dog pivoted to the free end of said starting pawl said dog having a bearing surface and a tooth; a fixed ratchet wheel with which said kick-out dog co-

operates, said fixed ratchet wheel loosely surrounding said shaft and having teeth arranged in a direction reverse to the teeth of said first named ratchet wheel; and a spring secured to said dog and tending to turn said dog so that its bearing surface is out of engagement with said fixed ratchet wheel and its tooth is in engagement with the teeth of said fixed ratchet wheel.

2. In a starting device for internal combustion engines, the combination with the engine shaft; of a cylindrical casing having central openings at its opposite ends for receiving said shaft, one end of said casing having an inwardly extending annular portion constituting a hub; a ratchet wheel secured to said shaft adjacent said hub; an operating wheel journaled upon said hub; a starting pawl pivoted upon said operating wheel and cooperating with said ratchet wheel; a kick-out dog pivoted to the free end of said starting pawl; said dog having a bearing surface and a tooth; a fixed ratchet with which said kick-out dog cooperates, said last mentioned ratchet surrounding said shaft and secured to said casing and having teeth arranged in a direction reverse to the teeth of said first named ratchet wheel; and a spring secured to said dog and tending to turn said dog so that its bearing surface is out of engagement with said fixed ratchet and its tooth is in engagement with the teeth of said fixed ratchet.

3. A starting device for internal combustion engines comprising, in combination with the engine shaft, a ratchet wheel secured to said shaft; an operating member loosely mounted concentric with said ratchet wheel; a starting pawl pivoted at one end to said operating member and cooperating with said ratchet wheel to drive the latter; a kick-out dog pivoted to the free end of said starting pawl; and a fixed ratchet wheel and a fixed disk with which said kick-out dog cooperates, said kick-out dog having a curved surface adapted to ride over the circumferential surface of said fixed ratchet wheel and disk in one position of said dog to reduce the wear upon the teeth of said fixed ratchet wheel, said dog also having a

tooth at one side thereof cooperating with the teeth of said fixed ratchet wheel.

4. In a starting device for internal combustion engines, the combination with the engine shaft; of a ratchet wheel secured to said shaft; an operating member loosely mounted concentric of said shaft; a starting pawl pivoted to said operating member and cooperating with said ratchet wheel to rotate the latter; a fixed ratchet wheel and a fixed disk supported independently of said shaft; a kick-out pawl pivoted to said starting pawl and provided with an arc-shaped surface adapted in one position of said kick-out pawl to rest upon the circumference of said fixed ratchet wheel and disk to hold said starting pawl in an inoperative position, said disk providing a running surface for the arc-shaped surface of said kick-out pawl, said kick-out pawl having a tooth adapted to cooperate with said fixed ratchet wheel to turn said kick-out pawl to either of its alternative positions.

5. A starting device for internal combustion engines comprising, in combination with the engine shaft, a ratchet wheel secured to said shaft; a loosely mounted operating wheel concentric with said ratchet wheel; a spring-pressed starting pawl pivoted at one end to said operating wheel and engaging at its other end with said ratchet wheel; a kick-out dog pivoted upon the free end of said pawl and arranged to assume either a position approximately at right angles to said pawl or a position in which the free end of the dog is turned toward the free end of said pawl; a spring secured at one end to said dog and at its other end to said operating wheel at a point beyond the end of said pawl; and a fixed ratchet with which said kick-out dog cooperates, said fixed ratchet being concentric with said ratchet wheel.

In witness whereof, I hereunto subscribe my name this twenty-eighth day of August, 1913.

HARRY F. BENNETT.

Witnesses:

McClellan Young,
George P. Barton.