G. C. GOODHART.

SELF STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 14, 1911.

1,009,503. Patented Nov. 21, 1911.

FIG. 1

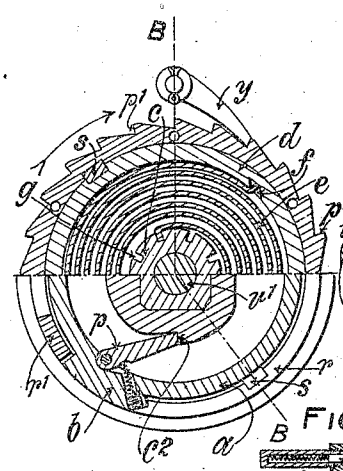


FIG. 2.

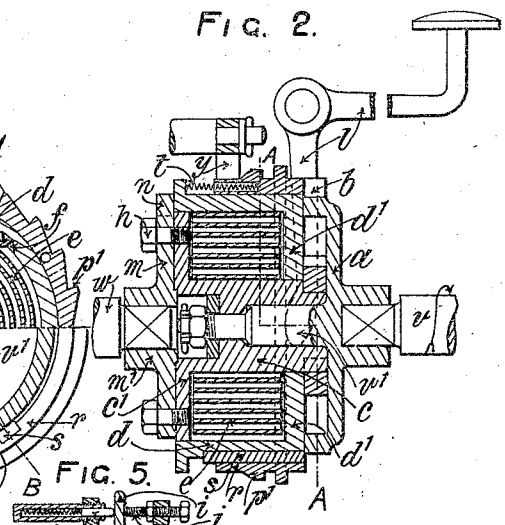


FIG. 5.

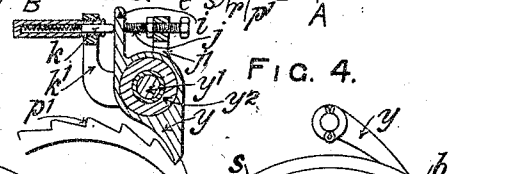


FIG. 3.

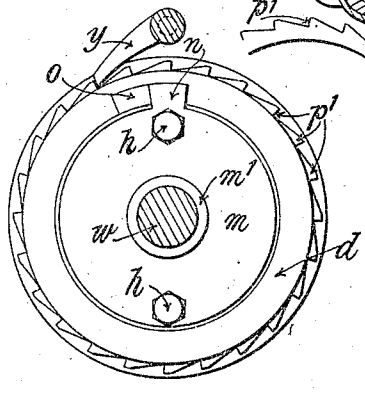
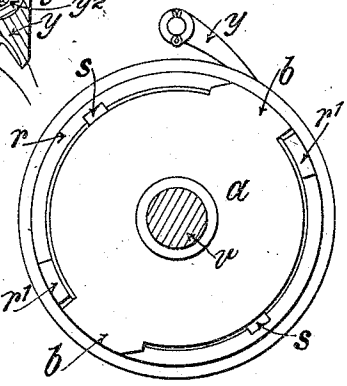


FIG. 4.



WITNESSES

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SELF-STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,009,503. Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed April 14, 1911. Serial No. 621,094.

To all whom it may concern:

Be it known that I, GAVIN CAIRD GOODHART, a subject of the King of Great Britain and Ireland, residing at Willows, Inkpen, Berkshire, England, have invented certain new and useful Improvements in Self-Starting Devices for Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to self-starting devices for use with internal combustion engines of the type in which the power necessary to rotate the crank-shaft of the engine for the purpose of starting it is obtained from a spring which is automatically wound up by the engine, and it has for its object the general improvement of this type of self-starting device by the embodiment of the following essential features: (1) one or more stops to limit the range of action of the spring in both directions so that after the spring is wound up the drive ceases to be through the spring, (2) the arrangement of the parts of the apparatus concentric with one another whereby its overall length is materially shortened, and (3) the arrangement of the main clutch exterior to the periphery of the spring whereby less power is required to release it under pressure.

In the accompanying drawing which shows—by way of example—a form of construction for an engine rotating clockwise and adapted to be employed in a motor car and to be placed between the engine and the change speed gear of such car Figure 1 is a view in transverse section on line A—A Fig. 2, Fig. 2 is a view in longitudinal section on line B—B Fig. 1, Figs. 3 and 4 are end views of the complete device, and Fig. 5 is a view showing a modification.

Throughout the views similar parts are marked with like letters of reference.

The clutch-shaft is divided into two parts v and w, the former being the part connected to the clutch and the latter the part connected to the transmission gear. On the part v is fixed a disk a which carries on its periphery a series of dogs b forming one part of the main clutch and on its inner face an extension v^1 which forms a continuation of the shaft v. On said extension is loosely mounted a sleeve c which carries a radially arranged flange c^1. Concentric with the sleeve c and flange c^1 is a drum d having a radially arranged internal flange d^1, said sleeve and flange c and c^1 and drum and flange d and d^1 forming together a case within which the spring e is located. The inner end of the spring is fixed to the sleeve c and the outer end thereof to the drum d, the preferred construction being to turn up the ends of the spring so as to form hooks, the outer one of which engages a slot or notch f in the inner face of the drum d and the inner of which is adapted to engage one of a series of longitudinally arranged slots or notches g in the sleeve c. The series of slots or notches g provide compensation for any variation in the length of the spring. The sleeve c is arranged to rigidly engage the part w of the clutch-shaft, a convenient arrangement being to fix, by means of screws h or the like, to the flange c^1 a disk m having a boss m^1 adapted to be fixed to the shaft w. On the flange c^1 or on the disk m fixed thereto, as shown on the drawing, is a stop n which is adapted to engage with a stop o carried by the drum d so as to limit the range of action of the spring e to slightly less than one revolution. On the disk a is pivoted a pawl p which is adapted to engage ratchet teeth c^2 on the sleeve c^1. On the exterior of the drum d is concentrically mounted a sleeve r which is adapted to slide longitudinally on said drum but to rotate with it through the medium of the keys or feathers s. This sliding sleeve carries dogs r^1—forming the other part of the main clutch—which engages the dogs b carried by the disk a when longitudinal motion is imparted to said sleeve. This is preferably effected in one direction, viz. that to cause the dogs to engage by means of springs such as t and in the other direction to release the dogs and therefore the two parts v and w of the clutch shaft by means of a bell-crank lever l pivoted to any convenient fixed part in relation to the mechanism. One arm of this lever is adapted to be operated either by the foot as shown or by hand, and the other end to contact the sliding sleeve r. Pivoted to any convenient fixed part exterior to the sliding sleeve r is a pawl y adapted to engage one of a series of ratchet teeth p^1 formed on or carried by the sleeve r, the arrangement of said pawl and ratchet teeth being such that when said parts are in engagement the drum d is prevented from rotating in the reverse direction to the clutch shaft. It will be seen that in this construction the inner end of the spring e is always fixed to the shaft w

but that the outer end of said spring is only fixed to the shaft v when the dogs b and r^1 are in engagement. It will also be seen that the spring e is arranged to make slightly less than one complete revolution in unwinding, the engagement of the stops n and o preventing it either being unwound too much or being overwound according on which side said stops engage.

The operation of the device is as follows:—To start the motor the lever l is operated to cause the sleeve r to slide to the left, thus bringing the ratchet teeth p^1 under the pawl y, which prevents the sleeve r and the drum d, which holds the outer end of the spring e, from revolving backward. At the same time the main clutch is disengaged by the dogs r^1 slipping out of engagement with the dogs b. This frees the disk a from the drum d and allows the spring to operate to cause the sleeve c to rotate clockwise and drive the shaft v through the ratchet c^2 and pawl p, which gives the crank-shaft of the motor the necessary rotation to start the engine. The stop o is now on the left-hand side of the stop n. the lever l is immediately operated to return the sliding sleeve r so that the dogs b and r^1 engage again, which causes the whole of the starting device to revolve with the shaft v. The clutch-shaft is then engaged with the transmission gear and on the clutch being let in the drum d will be driven by the engine through the disk a, the dogs b and r^1, and the sleeve r and as the shaft w is prevented from rotating by the resistance of the car the spring e will be wound up until the stop n comes around to the other side of the stop o when the drive becomes solid through the said stops and the power of the engine is imparted to the car through the transmission gear. The spring e is prevented from unwinding by the ratchet teeth c^2 and the pawl p which also take the drive when the car is driving the engine as a brake. If the engine has four cylinders the starter will only rotate the crank-shaft over two compressions which is usually sufficient, but if the spring e is strong enough some of its energy will pass into the fly wheel of the engine which may carry it around still farther.

To reduce the shock when the pawl y employed to prevent the backward rotation of the drum d to which the outer end of the operating spring e is connected comes into engagement with the ratchet teeth p^1 on the sliding sleeve r, the pawl y instead of being mounted directly on its pivotal pin y^1 is mounted on a rubber bush y^2 so as to make it resilient, and in order to keep the engaging end of the pawl clear of the sleeve carrying the ratchet teeth p^1 when the device is not in operation and to keep the engaging end of the pawl down on to the ratchet teeth an adjustable stop such as j and a spring finger such as k are provided, with which an ear i carried by the boss of the pawl engages, said stop and finger being carried respectively by suitable brackets j^1 and k^1 mounted on or carried by any suitable fixed part.

Although in the construction illustrated only one pair of stops n and o are shown, additional pairs may be employed in order to equalize the drive by stepping each additional pair so that while registering with one another they clear the other pair or pairs.

This starting device can conveniently be combined with the ordinary form of sliding wheel change speed gear by mounting said device on the countershaft of said gear within the gear box. In such a construction the disk a would be coupled to the spur wheel on the countershaft, by which said shaft receives its motion from the primary shaft of the gearing, and the sleeve c would be fixed on said countershaft.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a self-starting device, the combination of a disk connected to the crank-shaft of the engine, a sleeve coupled to the transmission mechanism by which the engine is coupled to its load, a drum mounted on said sleeve, a spring operating between said sleeve and said drum—the inner end of said spring being anchored to the sleeve and the outer end thereof to the drum, a sliding sleeve mounted to rotate with said drum, means for imparting a longitudinal movement to said sliding sleeve, ratchet teeth on said sliding sleeve, a pawl mounted on a fixed pivot and adapted to engage said ratchet teeth, a clutch adapted to couple the disk to the drum through the sliding sleeve, a ratchet and pawl adapted to couple the disk to the sleeve carrying the inner end of the spring when rotating in one direction, and two stops—the one carried by the sleeve carrying the inner end of the spring and the other carried by the drum carrying the outer end of the spring.

2. In a self-starting device, the combination of a disk connected to the crank-shaft of the engine, a sleeve coupled to the transmission mechanism by which the engine is coupled to its load, a drum mounted concentrically on and over said sleeve, a spring concentrically mounted in relation to and operating between said sleeve and said drum—the inner end of said spring being anchored to the sleeve and the outer end thereof to the drum, a sliding sleeve mounted in concentric relation to said drum and adapted to rotate with it, means for imparting a longitudinal movement to said sliding sleeve, ratchet teeth on said sliding sleeve, a pawl mounted on a fixed pivot and adapt-

ed to engage said ratchet teeth, a clutch adapted to couple the disk to the drum through the sliding sleeve, a ratchet and pawl adapted to couple the disk to the sleeve carrying the inner end of the spring when rotating in one direction, and two stops—the one carried by the sleeve carrying the inner end of the spring and the other carried by the drum carrying the outer end of the spring.

3. In a self-starting device, the combination of a disk connected to the crank-shaft of the engine, a sleeve coupled to the transmission mechanism by which the engine is coupled to its load, a drum mounted on said sleeve, a spring operating between said sleeve and said drum—the inner end of said spring being anchored to the sleeve and the outer end thereof to the drum, a sliding sleeve mounted to rotate with said drum, means for imparting a longitudinal movement to said sliding sleeve, ratchet teeth on said sliding sleeve, a pawl adapted to engage said ratchet teeth, a fixed pivotal pin for carrying said pawl, an elastic medium between said pawl and its pivotal pin, a clutch adapted to couple the disk to the drum through the sliding sleeve, a ratchet and pawl adapted to couple the disk to the sleeve carrying the inner end of the spring when rotating in one direction, and two stops—the one carried by the sleeve carrying the inner end of the spring and the other carried by the drum carrying the outer end of the spring.

In witness whereof I have signed my name in the presence of two subscribing witnesses.

GAVIN CAIRD GOODHART.

Witnesses:
A. MILLWARD FLACK,
G. V. SYMES.