A. D. KENYON & E. D. THAYER.

MEANS FOR STARTING INTERNAL COMBUSTION ENGINES.

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1,067,257. Patented July 15, 1913.

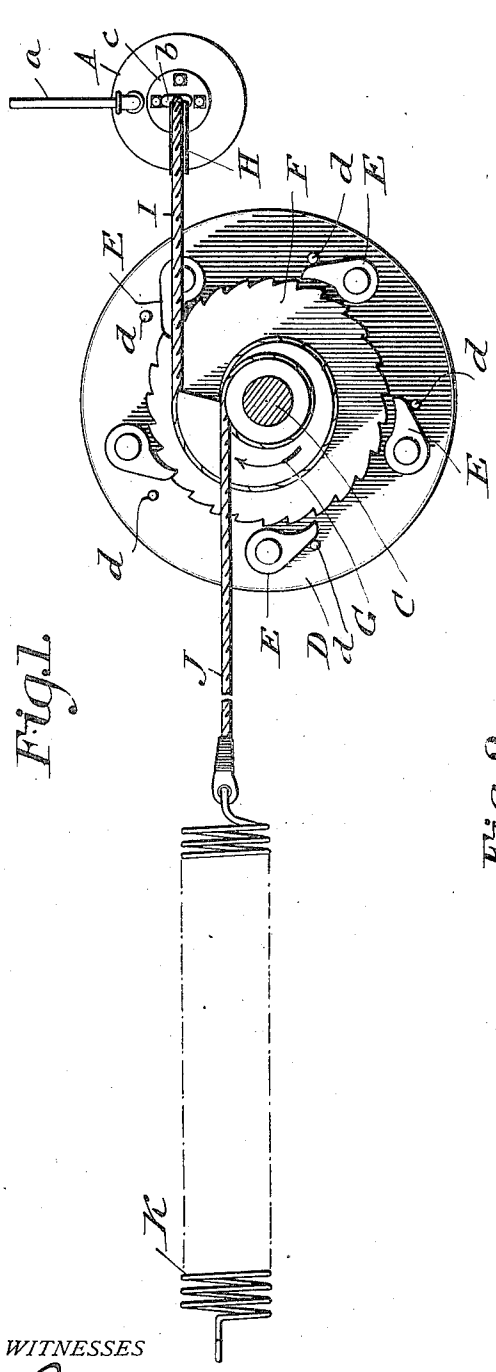


Fig. 1.

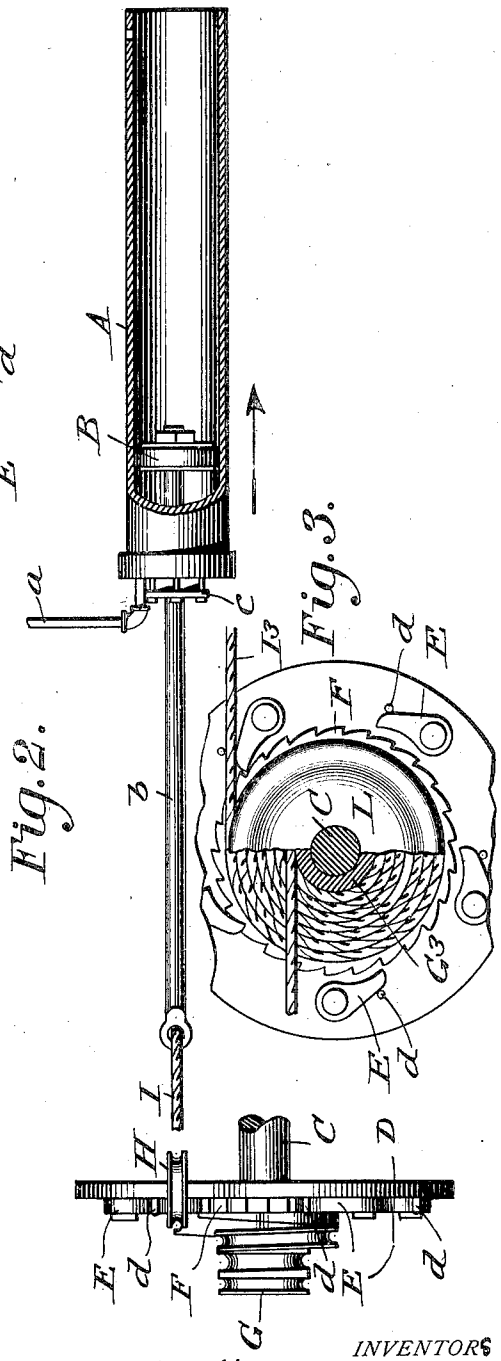


Fig. 2.

Fig. 3.

WITNESSES

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UNITED STATES PATENT OFFICE.

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MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES.

1,067,257. Specification of Letters Patent. Patented July 15, 1913.

Application filed October 5, 1911. Serial No. 652,900.

To all whom it may concern:

Be it known that we, ARTHUR DOUGLAS KENYON and EMERSON DELOS THAYER, citizens of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented new and useful Improvements in Means for Starting Internal-Combustion Engines, of which the following is a specification.

Our present invention pertains to means for starting internal combustion engines; and it contemplates the provision of an apparatus which while simple and inexpensive, is highly efficient in imparting to an engine shaft a rapidly increasing speed or much the same motion as is produced by hand cranking.

Other advantageous characteristics of the invention will be fully understood from the following description and claim when the same are read in connection with the drawings accompanying and forming part of this specification, in which:

Figure 1 is a front elevation of the apparatus constituting the best practical embodiment of our invention that we have as yet devised; the tractile spring comprised in said embodiment being shown partly by full lines and partly by dotted lines. Fig. 2 is a broken view, partly in section, taken at a right angle to Fig. 1. Fig. 3 is a detail view, partly in elevation and partly in section, illustrative of a modified drum hereinafter specifically referred to.

Referring by letter to the said drawings, and more particularly to Figs. 1 and 2 thereof: A is a cylinder, equipped with a pipe *a* through which fluid under pressure may be introduced to move the piston B in the direction indicated by arrow in Fig. 2; the said piston B being provided with a rod *b* that extends through a stuffing box *c* on one head of the cylinder. C is the shaft of an internal combustion engine, and to said shaft the cylinder A is preferably, though not necessarily, arranged parallel, as will be readily understood by comparison of Figs. 1 and 2. Fixed on the shaft C is a disk D, and carried by the said disk D are one or more (preferably five), pawls E, adapted to be thrown outward by centrifugal action until they bring up against suitable stops *d* on the disk D. Loosely mounted on the shaft C in front of the disk D is a toothed disk F, and also loosely mounted on the shaft C and fixed with respect to the disk F is a tapered and preferably grooved drum G; the taper of the drum being by preference in a direction away from the disks D and F. Passed around a suitably supported sheave H, and interposed between and connected to the piston rod *b* and the drum G is a cable I, which, as clearly shown in Fig. 1, is so arranged, relative to the drum G, as to be first unwound from the portion of the drum that is of the largest diameter, this being advantageous inasmuch as when the piston is moved in the direction of the arrow in Fig. 2, the cable I imparts to the drum a rapidly increasing speed to rotate the shaft C in much the same manner as when a shaft is rotated through the medium of a hand crank.

While we have referred hereinbefore to the element G as a drum, we would have it understood that any revoluble member other than a drum and suitable to the purpose of our invention may be employed in lieu of the drum without involving departure from the scope of our invention as claimed.

Connected to the drum G and positioned to be wound thereon in reverse direction to the cable I is a cable J, and connected at one end to the cable J is one end of a tractile spring K, the other end of which is adapted to be connected to a suitable support (not shown) that is fixed at one side of the shaft C.

In the practical operation of our improved apparatus the parts which normally rest in the positions shown in Fig. 1, are moved by the letting of fluid under pressure into the cylinder A back of the piston B, inasmuch as such introduction of fluid under pressure into the cylinder A will, through the piston and the piston rod, draw the cable I off the drum G, and by so doing will rotate both the drum G and the disk F in the direction indicated by arrow in Fig. 1. The rotation of the disk F in the direction stated enables the said disk by acting against one or more of the pawls E to rotate the disk D and the engine shaft C in a corresponding direction, and then when the engine is started, centrifugal action will manifestly maintain the pawls E out of engagement with the teeth of the ratchet F, so that the normal running of the engine will not be attended by wear of either the pawls or the ratchet teeth. When the piston

B is moved and the drum G rotated as stated to start the engine, the cable J will be wound on the drum G in reverse direction to the cable I, and the spring K will be stretched or put under tension. From this it follows that when the fluid under pressure is released from behind the piston B, the tractile spring K by resuming its normal state, will draw upon the cable J and thereby rotate the drum G in the direction opposite to that indicated by arrow in Fig. 1, to take up the cable I on the drum G and restore the piston B to the position shown in Fig. 2.

In lieu of a tapered and spirally grooved drum G, such as shown in Figs. 1 and 2, a drum G^3 of even diameter throughout may be employed without involving departure from the scope of our invention as claimed. A drum G^3 is shown in Fig. 3, and such drum on its end remote from the disk F may or may not be provided with a retaining flange L. In the use of a drum such as G^3 in Fig. 3, a cable and particularly a cable of the sprocket chain type, will wind on itself, and this will afford in large measure the same effect as the winding of the cable I on the tapered and spiral drum G. From this it follows that the cable I^3 employed in combination with the drum G^3, is preferably in the form of a sprocket chain, though it is not essential that it be in such form, since a wire cable or the like will serve the purpose.

Having described our invention, what we claim and desire to secure by Letters-Patent, is:

Means for starting internal combustion engines, comprising an engine shaft, a disk fast on said shaft, a disk loose on the shaft and having a circular series of ratchet teeth, a stop on the face of the first-named disk, a pawl pivoted to said disk in position to be engaged by the ratchet teeth when the second-named disk is turned in one direction; said pawl being freely movable by centrifugal action between an interdental space of the second-named disk and the stop, a drum fixed with respect to the second-named disk, a cable wound in convolutions that are gradually reduced in size on the drum, means for drawing said cable in a direction away from the drum to rotate the drum and the disks, a cable wound in convolutions that are gradually increased in size on the drum when the drum is rotated through the first-named cable to rotate the disks, and means connected to the second-named cable for taking up slack thereof and rotating the drum in the opposite direction to take up the first-named cable on the drum.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

ARTHUR DOUGLAS KENYON.
EMERSON DELOS THAYER.

Witnesses:
A. R. WICKER,
W. A. TREPPARD.