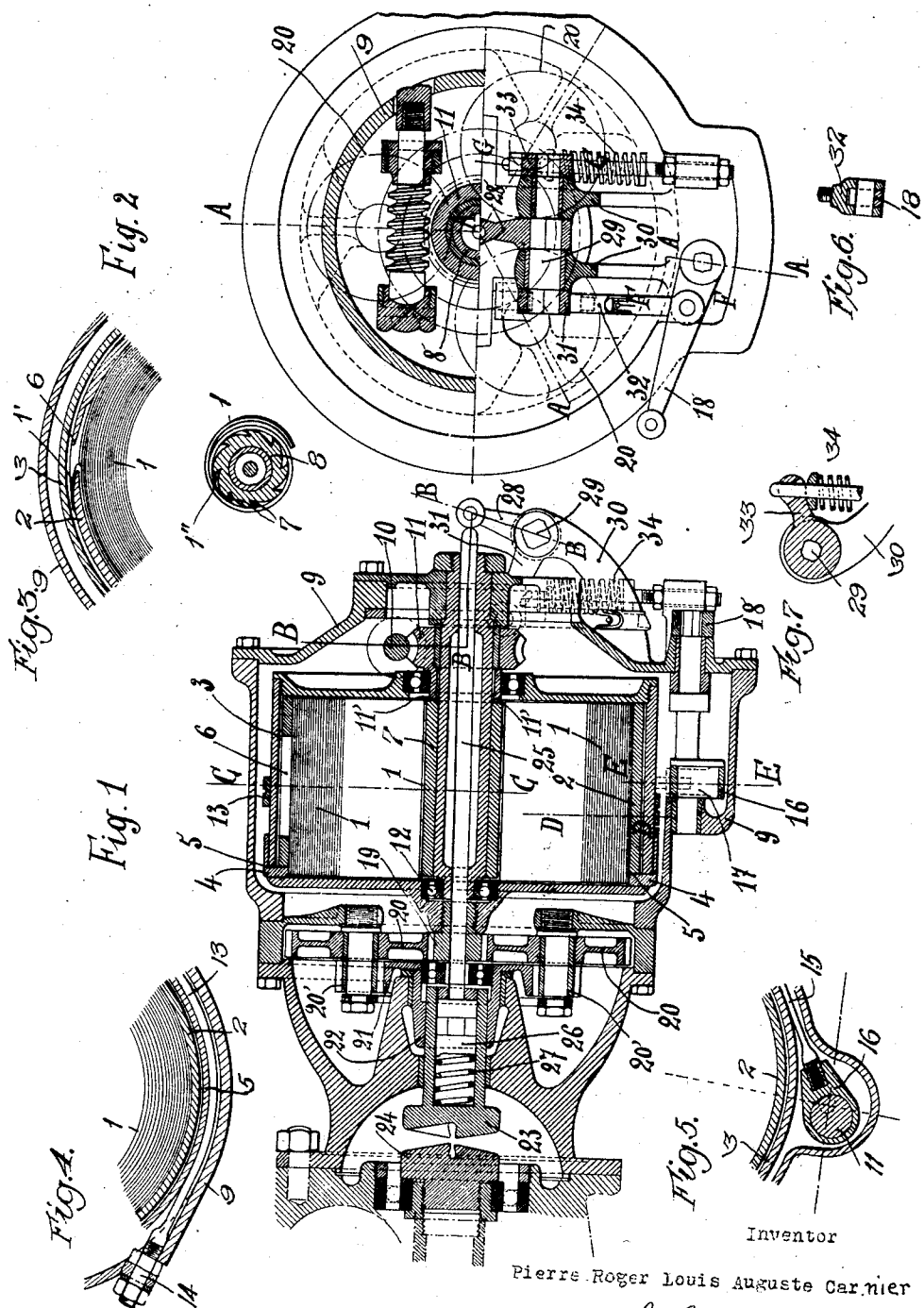
Dec. 15, 1925. 1,565,789

P. R. L. A. CARMIER

MECHANICAL STARTER FOR INTERNAL COMBUSTION ENGINES

Filed April 24, 1923 2 Sheets-Sheet 1



Inventor

Pierre Roger Louis Auguste Carmier

Edgar V. Brandenburg

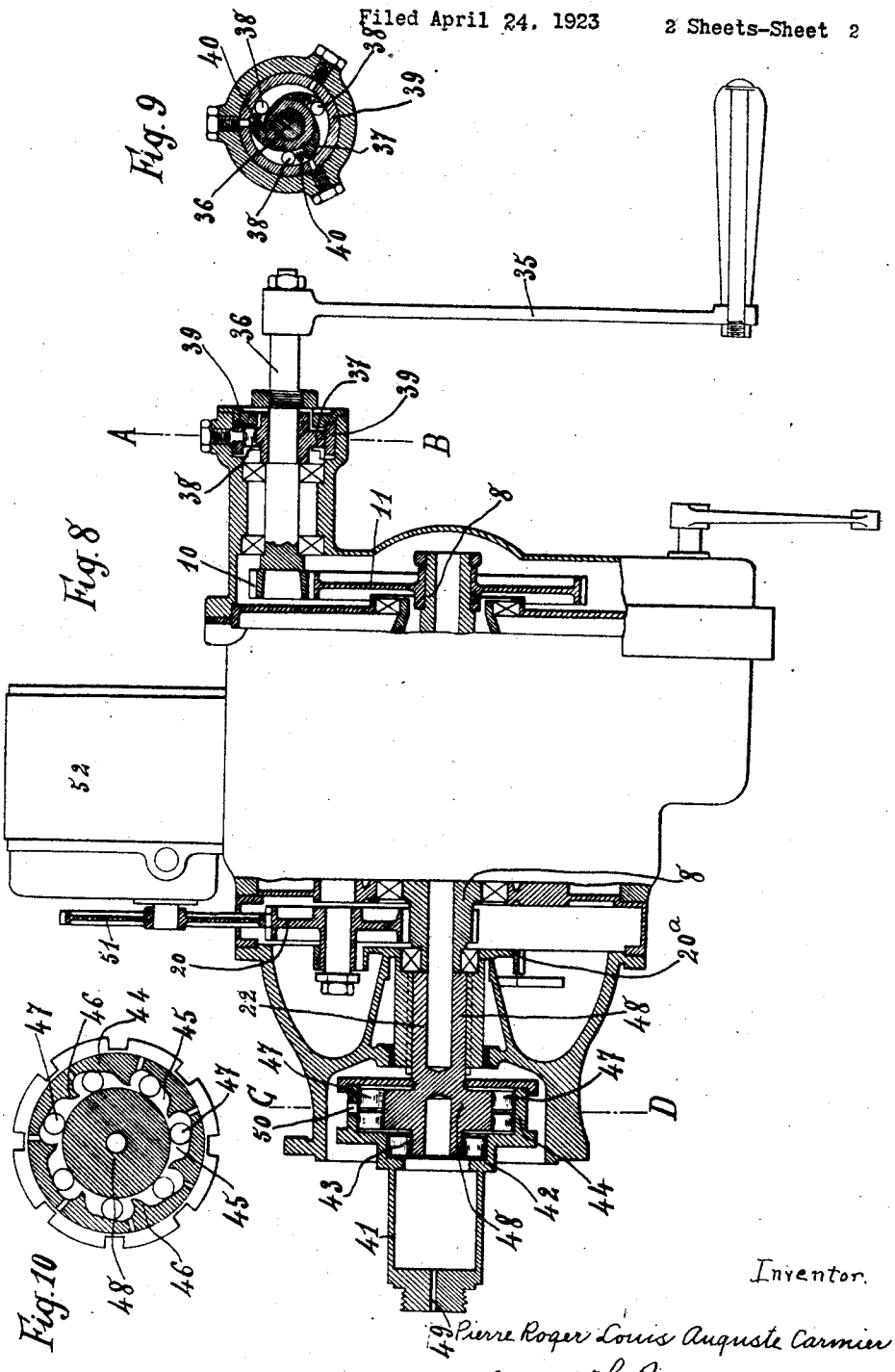
Attorney

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MECHANICAL STARTER FOR INTERNAL COMBUSTION ENGINES

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Inventor.

Pierre Roger Louis Auguste Carmier

Edgar J. Brandenburg

Attorney

Patented Dec. 15, 1925. 1,565,789

UNITED STATES PATENT OFFICE.

PIERRE ROGER LOUIS AUGUSTE CARMIER, OF PARIS, FRANCE, ASSIGNOR TO SOCIÉTÉ ANONYME DITE: MATÉRIEL ET ACCESSORIES D'AVIATION, OF PARIS, FRANCE.

MECHANICAL STARTER FOR INTERNAL-COMBUSTION ENGINES.

Application filed April 24, 1923. Serial No. 634,307.

To all whom it may concern:

Be it known that PIERRE ROGER LOUIS AUGUSTE CARMIER, citizen of the Republic of France, residing at Paris, 145 Rue de Clignancourt, Department of the Seine and Republic of France, have invented certain new and useful Improvements in Mechanical Starters for Internal-Combustion Engines, of which the following is a specification.

My invention relates to a mechanical starter for internal combustion engines which is characterized in that it comprises a spiral spring wound within a movable spring box, the said spring being secured at one end to the barrel and bearing at the other end, which is suitably curved, upon a movable toothed hub. The spring is wound up at the central part by means of a crank and suitable worms and gearing, the spring box being braked by a band controlled by an eccentric. The engine is started by means of an automatic clutch device one element of which is rotated by the movement of the said spring box when its brake is thrown off.

It will be seen that in this apparatus, which is entirely mechanical and operates in a very reliable manner, the spiral spring stores up energy which it returns at the proper time when the engine is to be started. The whole device has a light weight and the apparatus is secured to the crank case of the engine to be started.

The appended drawings show by way of example two embodiments of the invention.

Fig. 1 is a sectional view of the first form of construction of the starter, on the line A—A—A—A—A of Fig. 2.

Fig. 2 is a sectional view on the line B—B—B—B of Fig. 1.

Figs. 3, 4 and 5 are respectively part sections on the lines C—C, D—D, and E—E of Fig. 1.

Figs. 6 and 7 are part sections respectively on the lines F—F and G—G of Fig. 2.

Fig. 8 is a modified form of the starter, which is shown partly in longitudinal section and partly in elevation.

Figs. 9 and 10 are two transverse sections respectively on lines A—B and C—D of Fig. 8.

As shown in Figs. 1 to 7, the spiral spring 1 is placed in a barrel 2 which is secured to a spring box or drum 3 by the studs 4 of the latter which engage recesses in the barrel 2. The spring is attached to the barrel 2 as will be seen in Fig. 3, by bending the end 1′ of the spring so that it will be hooked in the slot 6. The other end 1″ of the spring is also bent and engages the toothed part or ratchet-sleeve 7 which is rigidly mounted on the hollow shaft 8, whereby the spring can be coupled to said shaft upon its entire width without forming an extra thickness or ridge which might distort the barrel.

The shaft 8 supported by the casing 9 of the starter can be rotated by a handle within reach of the driver, through suitable driving means, not shown, ending in the worm 10 and worm wheel 11 which drives the shaft 8 by means of the teeth 11′.

The spring box 3 rotates on the shaft 8 by means of the ball bearings 12 and it is surrounded by a brake band 13, Fig. 1, secured to the casing 9 at 14, Fig. 4, the other end of the band 15 being secured or otherwise fixed to a coupler 16, Fig. 5 serving as an eccentric strap for the eccentric disc 17 which is actuated from the outside by a lever 18, Fig. 2.

The spring box 3 ends at 19, Fig. 1, in a pinion engaging the double pinions 20, 20′ disposed in a triangle about the shaft so as to ensure an exact centering. The pinions 20′ drive the toothed disc 21 having a hub 22 supporting a clutch-member 23, which is splined to said hub so as to be rectilinearly movable relative to said hub and so as to be rotatable therewith.

The longitudinal movement of the clutch member 23 is effected by a rod 25 whose end 26 has the form of a piston, a spring 27 being placed between the end 26 and the clutch member. The rod 25 itself is driven by an arm 28 mounted on a shaft 29 turning in the bearings 30, whilst an arm 31 is acted upon by the lever 18 through the rod 32, Fig. 2. Another arm 33, Fig. 7, is acted upon by a spring 34, Figs. 1 and 2, which constantly returns the arm 28 to the rear.

The apparatus is operated as follows:

The clutch member 23 is engaged with the like member 24 by the operation of the lever 18; the rod 25 drives the clutch member by means of its head 26 and the spring 27. The winding handle is turned slowly, and when the clutch engagement has taken

place, it is maintained by reason of the shape of the said clutch members. The lever 18 is then released and under the action of the spring 34 is caused to swing; the brake 13 of the spring box is thrown on, and the rod 25 is returned by the action of spring 27.

When this has been carried out, the handle is turned so as to wind up the spring 1. The spring box 3 being now braked, the end 1 of the spring is held stationary and the windings of the spring tighten on the shaft.

After the apparatus has been wound up, in order to proceed with the starting of the engine it is simply necessary to give a sharp movement to the lever 18, and as the spring box is not braked at this moment, the spring 1 is instantly moved, thus actuating the clutch member and the engine is started. As soon as the engine is started, the clutch member 24 drives back the clutch member 23 so as to compress the spring 27 if the lever 18 has not yet been released. When the lever is released, the spring box will be braked and as the spring expands it will continue this motion by inertia, but as it is now secured at 1', its end 1'' will yield and will act as a ratchet upon the teeth of the shaft 8, so that there is no risk of abnormal stress or of damage to the spring.

The starter as shown in Figs. 8 to 10 is provided with various improvements as compared to the one above described. These improvements chiefly relate to the winding of the spring, the device for driving the engine and the use of a starting magneto.

As illustrated in Figs. 8 to 10, the spring is wound up by a handle 35 keyed to a shaft 36 which has at the other end a pinion 10 engaging a gear wheel 11 keyed to the shaft or core 8 of the starter. The gear wheels 10 and 11 may obviously have the form of bevel gears. If desired, a Cardan shaft can be placed between the winding shaft 36 and the handle 35. The retaining means consists of a cam with multiple steps 37 keyed to the shaft 36 and ensuring during the retaining period the jamming of the rollers 38 upon an exterior circular cage 39. The continuous adhesion of the rollers 38 is ensured by means of springs 40 pressing upon the bottom of the steps of cam 37.

It will be understood that the shaft 36 can rotate freely under the action of the handle 35 in the direction of the winding up of the spring since this rotation will tend to bring back the rollers 38 at the bottom of the steps of the cam whilst the rotation of shaft 36 in the other direction is prevented by the jamming of the rollers 38 which tend to rise upon the steps.

The engine is actuated by a member 41 screwed to the crankshaft and comprising on the one hand a circular cage 42 having rotating therein the rollers 43, and on the other hand a toothed disc 44 provided with various inclined recesses 45 provided with steps for the reception of the rollers 47.

The driving clutch used in the preceding embodiment is now eliminated and is replaced by a central piece 48 provided with grooves co-operating with the annular part 22 secured to the driving toothed disc 20''. The end of the central piece 48 comes into contact with the annular roller path 43, and is enabled by means of its enlarged part to come into contact (or not) with the rollers 47 contained in the recesses 43.

When the starter is actuated to start the engine, the rotation of the part 48 drives the rollers 47 upwardly on the steps of their recesses owing to the jamming of the rollers, the part 41, 42 is actuated so as to start the engine. When the engine has been started, the rollers 47 become automatically released by reason of the increased speed of the part 41, 42 and under the action of centrifugal force they are impelled towards the periphery at the bottom of the recesses, thus entirely releasing the starter from the engine.

In order to lubricate the said rollers in a continuous manner the oil under pressure is made to enter the crankshaft through the orifice 49, and this oil passes through the bearings 43 and 47 and is discharged through the orifices 50, this action being aided by centrifugal force. When the engine is at rest, the oil flows through the holes 50 and will not interfere with the action of the jamming rollers 47 serving to actuate the engine.

To facilitate the starting of the engine, one can use to advantage the pinion 20 which is actuated by the starter, in order to drive by means of the gear wheel 51 a starting magneto 52 which furnishes a hotter spark whereby the engine can be started.

Obviously, the said devices are susceptible of various modifications in detail without departing from the principle of the invention.

Having now described and ascertained the nature of my said invention and the best way I know of carrying it out in practice, I declare that what I claim is:—

1. A mechanical starter for internal combustion engines comprising a casing secured to the crank case of the engine, a spring box revoluble in said casing, a spiral spring wound therein and secured to the same at its outer end, a shaft passing through the spring box, a device for winding the spring which acts upon the inner end thereof, an extension of the shaft of the spring box which is independent of the said shaft and is adapted to be driven by the spring box, an actuating disk mounted on the end of the engine shaft, a coupling device acting by

the jamming of rollers situated between said disk and the extension of the axle of the spring box, and means for immobilizing the spring box during the winding and the stopping and for releasing the same when starting the engine.

2. A mechanical starter for internal combustion engines comprising a casing secured to the crank case of the engine, a spring box revoluble in the said casing a spiral spring wound therein and secured to the same at its outer end, a shaft passing through the spring box, a device for winding the spring which acts upon the inner end thereof, an extension of the shaft which is independent of the said shaft and is adapted to be driven by the said spring box, an actuating disk mounted on the end of the engine shaft, a clutch device operating by controlled rollers and situated between the said casing and the extension of the shaft of the spring box, a centering thrust bearing with the rollers interposed between the inner end of the said disk and the end of the extension of the shaft of the spring box, and means for immobilizing the spring box during the winding and the stopping and for releasing the same when starting the engine.

3. A starting device for internal combustion engines comprising a casing secured to the crank case of the engine, a spring box revoluble in the casing, a shaft passing through the said spring box and ending in an independent extension adapted to be actuated by the said spring box, a spiral spring wound in the said spring box and interposed between the latter and the shaft, a clutch for temporarily coupling the engine shaft with the said extension of the shaft of the spring box, means for clutching the spring box during the periods of stopping and winding, and a starting magneto actuated by the spring box.

In testimony whereof I affix my signature.

PIERRE ROGER LOUIS AUGUSTE CARMIER.