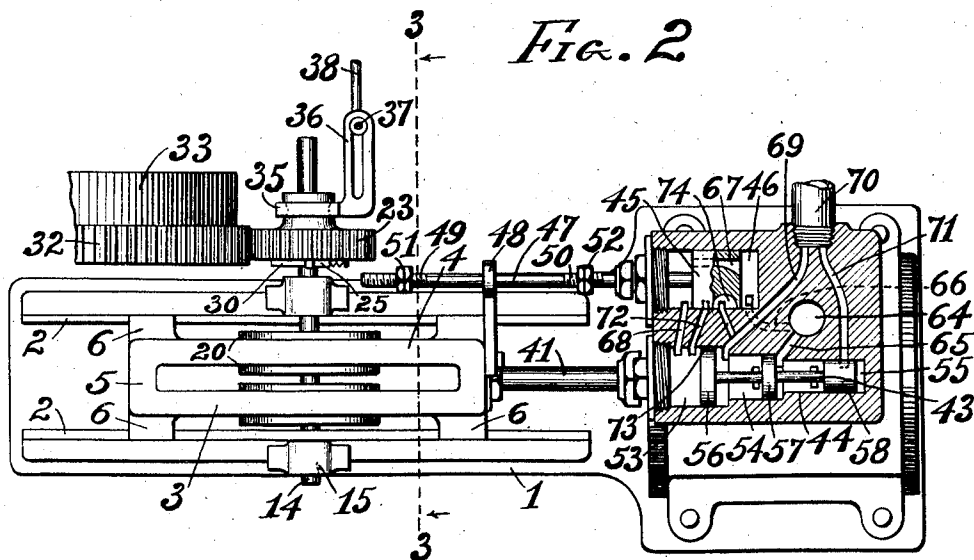


1,078,151.

2 SHEETS—SHEET 1.



M. Kellogg
J. Graham.

By *G. E. Hurst*
his Attorney

B. I. LAMB.
STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.
APPLICATION FILED OCT. 23, 1912.

1,078,151.

Patented Nov. 11, 1913.

2 SHEETS—SHEET 2.

FIG. 3

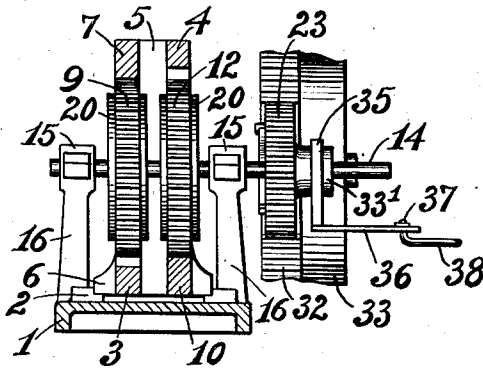


FIG. 4

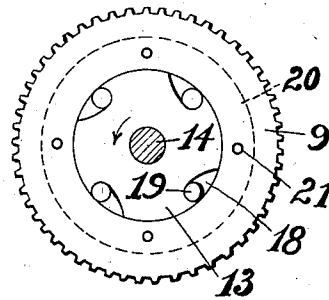


FIG. 5

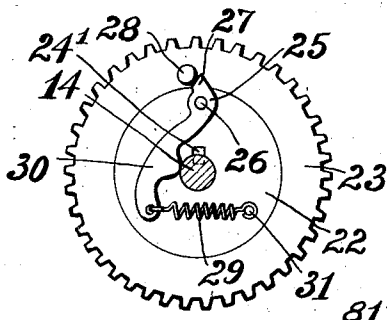


FIG. 6

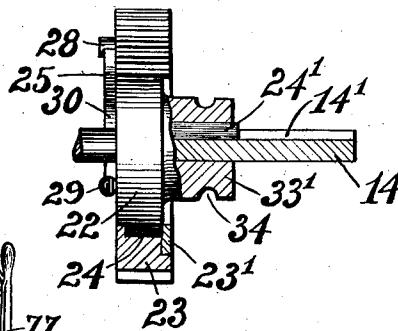
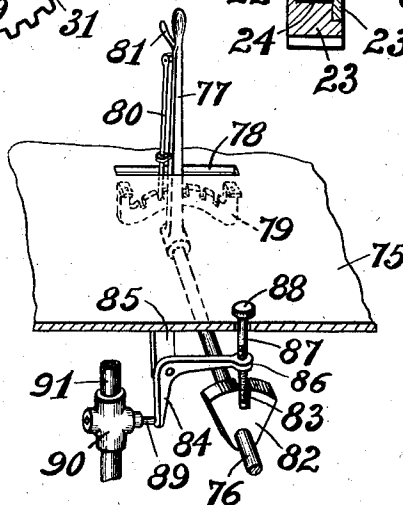


FIG. 7



Witnesses
W. H. Nelsby
J. Graham

Inventor
Burt I. Lamb
By *W. H. Nelsby*
his Attorney

UNITED STATES PATENT OFFICE.

BURT I. LAMB, OF NORWALK, OHIO, ASSIGNOR OF ONE-HALF TO HARRY R. MASON, OF MONROEVILLE, OHIO.

STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,078,151.

Specification of Letters Patent.

Patented Nov. 11, 1913.

Application filed October 23, 1912. Serial No. 727,461.

To all whom it may concern:

Be it known that I, BURT I. LAMB, a citizen of the United States, residing at Norwalk, State of Ohio, have invented certain new and useful Improvements in Starting Devices for Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in starting devices for internal-combustion engines and is particularly designed for the purpose of starting automobile engines to avoid the necessity of manually cranking the same.

The invention consists of certain mechanism whereby compressed air or other suitable motive fluid is utilized to start the engine.

Furthermore means are provided for preventing injury to the mechanism due to the back-fire of the engine.

In order that the invention may be fully understood, reference will be had to the accompanying drawings which illustrate a preferred embodiment thereof, and the novel feature of the invention will be distinctly pointed out in the appended claims.

In the drawings like characters of reference indicate corresponding parts.

Figure 1 is a side elevation of a device constructed in accordance with my invention, part being shown in section, Fig. 2 is a plan view of Fig. 1, a part thereof also being shown in section, Fig. 3 is a cross-sectional elevation, taken on line 3—3 of Fig. 2, Fig. 4 is a side elevation, on an enlarged scale, of a gear ring mounted on its disks, Fig. 5 is a side elevation, on an enlarged scale, of the driving gear and its releasing means in case of back-fire of the engine, Fig. 6 is a face view of Fig. 5, part being broken away, and Fig. 7 is a perspective view illustrating the means for preventing the starting of the engine unless the speed lever is in neutral position.

Referring to the drawings, 1 represents a base which is provided with longitudinal guides 2 for slidably supporting a carriage consisting of a pair of rectangular frames 3 and 4 arranged side by side in spaced relation and connected together at their ends as indicated at 5. The base of the carriage is provided with lateral feet 6 at its ends for supporting it on the guides 2. The under face of the upper side 7 of the rectangular frame 3 is provided with rack

teeth 8 for meshing with the teeth of a gear ring 9, and the upper face of the lower side 10 of the rectangular frame 4 with teeth 11 for meshing with a like gear ring 12.

Each of the gear rings 9 and 12 are rotatably mounted on disks 13 of a corresponding thickness, which disks are fixed to a transverse shaft 14 rotatably supported in bearings 15 carried by pedestals 16 projecting from the base 1. In order that the gear ring 9 will become locked to its disk 13 when the carriage is traveling in the direction indicated by the arrow 17 and thereby rotate the shaft 14 counter clockwise, and also permit said gear ring to revolve freely on its disk when the carriage is reciprocated in the opposite direction, the following means are provided. The periphery of said disk 13 is recessed at 18 for receiving rollers or balls 19, which will act as wedges for locking the gear ring to the disk when the gear ring is rotated counter clockwise, but allow the gear ring to revolve freely in the opposite direction. The disk, on which is mounted the gear ring 12, is similarly recessed for carrying rollers, and it will be noted that as the rack teeth 11 of the rectangular frame 4 are on its lower side 10 instead of the upper side 7 as in the other frame 3, the gear ring 12 will be alternately rotated in the reverse direction to the gear ring 9. Consequently there is a continuous rotation of the transverse shaft 14 in one direction. The rollers are retained within the recesses 18 of the disks 13 by means of circular plates 20 which are fixed to the sides of the gear rings as indicated at 21.

The rotation of the transverse shaft 14 is transmitted to the internal-combustion engine crank shaft, and danger to the mechanism on account of back-fire of the engine is obviated by the following means. A disk 22 is rotatably mounted on the transverse shaft 14 and loosely mounted on said disk is a driving gear 23, which is recessed as shown at 24 for fitting over said disk. A flange 23¹ is fixed to the outer side of said gear 23 for keeping same on the disk. The disk has an elongated hub 33¹ and is provided with a feather-key 24¹ which is adapted to slide in a key-way 14¹ of the shaft 14. By sliding the disk 22 longitudinally, the driving gear 23 is adapted to be thrown into engagement with a gear 32 rigidly secured to the rim 33 of the fly-wheel of the inter-

nal-combustion engine for starting same. The disk is made to turn the gear 23 as follows. A pawl 25 is pivoted at 26 to the side of the disk 22 and its nose 27 is normally held against an abutment pin 28 projecting from the side of the driving gear 23 by means of a coiled spring 29 which is connected to the curved arm 30 of the pawl and has its other end attached to a pin 31 fixed in the side of the disk 22. The pawl 25 is limited against the action of the spring 29 by its arm 30 engaging the shaft 14. Should the engine back-fire, it will be apparent that the driving gear 23 may freely rotate clock-wise as the abutment pin 28 would trip the pawl 25 against the action of the spring 29, thereby preventing the stripping of the gears.

The driving gear 23 may be thrown into and out of engagement with the gear 32 on the rim of the fly-wheel by any suitable means. As shown, the disk 22 is provided with an elongated hub 33¹ having a groove 34 for receiving a collar 35, which is fixed to a slotted arm 36 slidably connected to the upturned end 37 of an operating rod 38. Said rod being connected to an automatic timer.

The compressed air mechanism for actuating the carriage will now be described. Located on the rear end of the base 1 and in alinement with the travel of the carriage is a power cylinder 39 in which is slidably mounted a piston 40 having a piston rod 41 which is connected to the rear end of the carriage as indicated at 42. The inlet and exhaust to the power cylinder is controlled by means of a slide valve 43 arranged in a longitudinal chamber 44 above the cylinder, and the inlet and exhaust to said chamber is governed by a controlling valve 45 slidably mounted in a bore 46 lateral of the chamber 44 and actuated by the carriage. The controlling valve 45 is fixed to a valve stem 47 having its free end slidably mounted in a hole through a bracket arm 48 which is secured to the rear end of the carriage. The valve stem 47 is threaded at each side of the bracket arm 48 as shown at 49 and 50 for carrying stop nuts 51 and 52 which may be so adjusted on the valve stem as to be engaged by the bracket arm for imparting proper movement to the controlling valve 45.

The valve chamber 44 is formed in three sections having different diameters as indicated at 53, 54 and 55, and the slide valve 43 is made with three corresponding heads 56, 57 and 58 to give different pressure areas for a purpose as will be hereinafter explained. A port 59 establishes communication between the valve chamber section 54 and the forward end of the power cylinder 39, and a similar port 60 between the valve chamber section 55 and the rear end of the

cylinder. The valve head 58 is hollowed out from its free end at 61 and an opening 62 in its lower wall is adapted to register with the port 60 to allow the escape of the exhaust from the rear end of the power cylinder 39 at the proper time. The inlet pipe is represented by 63, which is connected with the inlet 64 having a port 65 leading to the rear end of the valve chamber section 54 and another port 66 extending to the rear end of the controlling valve bore 46. The controlling valve 45 is provided with a longitudinal channel 67, which extends therethrough to permit communication from the inlet port 66 through a conduit 68 to the forward end of the valve chamber section 53. An exhaust port 69 leads from the valve chamber section 53 to an exhaust pipe 70, and an exhaust port 71 from the valve chamber section 55 to said exhaust pipe. Also exhaust from the valve chamber section 53 to the exhaust port 69 takes place through an exhaust passage 72 leading to the controlling valve bore 46, and an exhaust passage 73 extending therefrom to said exhaust port. The controlling valve 45 being provided with a saucer shaped recess 74 for connecting the exhaust passages 72 and 73 at the proper time.

A general description of the operation of the above described mechanism follows: Assuming that the parts are as shown in Figs. 1 and 2, the compressed air is admitted through the inlet pipe 63 to the inlet 64, then passes through the port 65 and the port 60 to the rear end of the power cylinder 39 to drive the piston 40 forward and thereby move the carriage comprising the frames 3 and 4 in the direction indicated by the arrow 17. The rack teeth 8 of the frame 3 will rotate the gear ring 9 counter clockwise, and through the wedging action of the rollers 19 will drive the disk 13 and the shaft 14 fixed thereto in the same direction. This motion will be imparted to the disk 22 which is keyed to said shaft, and to the gear 23 through the medium of the pawl 25. As the gear 23 is in mesh with the gear 32 on the engine fly-wheel, the crank shaft of the engine will be rotated in the proper direction for starting the engine. It will be understood that when the frame 3 is driving the shaft 14, the gear ring 12 revolves freely on its disk in the opposite direction and vice-versa. It will be noted that the compressed air also enters the controlling valve bore 46 through the port 66, then by way of the channel 67 and the conduit 68 to the section 53 of the valve chamber 44, and acting upon the head 56 holds the valve 43 in the position shown. When the carriage is almost to the limit of its forward movement, the bracket arm 48 engages the stop nuts 51 and causes the controlling valve 45 to move forward, there-

by cutting off the conduit 68 and at the same time, by means of the recess 74, permit the escape of the compressed air through the passages 72 and 73 from the forward end of the head 56 of the slide valve 43. The inlet pressure against the head 57 of the slide valve 43 forces said valve forward, whereby its head 56 will close the passage 72, and as the escape of the compressed air is cut off it will act as a cushion for the forward end of the valve. When the slide valve 43 moves forward, its head 57 passes to the other side of the port 59, the air between the heads 56 and 57 escaping by way of the exhaust passage 69, and its head 58 uncovers the exhaust passage 71 while the opening 62 of the head 58 registers with the port 60, thus the inlet pressure passes through the port 59 to the forward end of the power cylinder 39 and drives the piston 40 toward the rear end of the cylinder. When the carriage is almost to the limit of its return stroke, the bracket arm 48 strikes the stop nuts 52 and the controlling valve 45 is moved to its original position as shown. The pressure on the head 56 will also force the slide valve 43 to its original position as shown, and as the exhaust passage 71 is cut off by the head 58, the confined air will serve as a cushion for that end of the slide valve.

It will be apparent that so long as the compressed air or other suitable fluid is admitted to the inlet 63, the above operations will continue for properly starting an internal combustion engine. After the engine has been started the gear 23 may be thrown out of engagement with the gear 32 in the usual manner.

In order that the compressed air may not be turned on to operate the starting mechanism except when the speed lever is in its neutral position, the following means are provided: Referring to Fig. 7, the flooring of an automobile is represented by 75, and the operating shaft by 76 having fixed thereto the speed hand lever 77 which passes through a slot 78 in the flooring. A curved notched bar 79 is secured to the underside of the flooring, and a locking rod 80 slidably mounted on the hand lever 77 is adapted to be actuated by the finger lever 81 and lock the hand lever to the curved notched bar 79 in the well known manner. Fixed to the operating shaft 76 is a stop block 82 which is provided with a recess 83 in its upper edge. A bell-crank 84 is pivoted to a bracket 85 depending from the flooring 75, one arm of which terminates in a threaded boss 86 for carrying an adjustable screw 87 which engages the recess 83 of the stop block 82, when the speed lever 77 is in neutral position, and the screw 87 may then be forced downwardly by foot pressure on its head 88 to cause the other

arm of the bell-crank 84 to act against the stem 89 of a plunger valve 90 which is arranged in the supply pipe 91. When the speed lever 77 is in any other than neutral position, the screw 87 rests on the top edge of the stop block 82 and therefore cannot be forced downwardly to operate the valve 90.

Although the elements set forth and described are well adapted to serve the intended purpose, it is to be understood that slight changes in the details of construction and arrangement of the parts may be made within the scope of the claims.

Having fully described my invention, what I claim is:

1. In a starting device for an internal-combustion engine, the combination of a carriage, means for imparting a reciprocating movement to the carriage, a shaft, means for rotating the shaft in one direction from the reciprocating movement of the carriage, a driving gear loosely mounted on the shaft and adapted to mesh with a gear fixed to the crank shaft of the engine, a disk keyed to the first mentioned shaft, the driving gear being cupped out from one side and loosely mounted on said disk, a pawl pivoted to the outer face of said disk and normally resting on the first mentioned shaft, a pin projecting from the driving gear, and a coiled spring connected to the pawl and the outer face of said disk at the opposite side of the first mentioned shaft from the pivot point of the pawl for normally holding said pawl against said pin to drive the gear in one direction but allow it to freely revolve in the opposite direction in case of back-fire of the engine, substantially as described.

2. In a starting device for an internal-combustion engine, the combination of a carriage, means for imparting a reciprocating movement to the carriage, a rack carried by the carriage, a shaft, a disk fixed to the shaft, the disk being provided with recesses in its periphery, a gear ring loosely mounted on the disk and in engagement with said rack, rollers in the recesses of said disk for causing the gear ring to rotate said disk when the gear ring is revolved in one direction, a gear loosely mounted on said shaft and adapted to mesh with a gear fixed to the crank shaft of the engine, a second disk keyed to said shaft, a pawl pivoted to the second disk, a pin projecting from the first mentioned gear, and a spring for normally holding said pawl against said pin to drive the gear in one direction but allow it to freely revolve in the opposite direction in case of back-fire of the engine, substantially as described.

3. In a starting device for an internal-combustion engine, the combination of a carriage, means for imparting a reciprocating movement to the carriage, a shaft, means for continuously rotating the shaft in one direc-

tion from the reciprocating movement of the carriage, a disk feather keyed to said shaft for rotating the same but permitting longitudinal movement thereon, a gear loosely mounted on said disk and adapted to mesh with a gear fixed to the crank shaft of the engine, a pawl pivoted to said disk, a pin projecting from the first mentioned gear, and a spring for normally holding said pawl
10 against said pin to drive the gear in one di-

rection but allow it to freely revolve in the opposite direction in case of the back-fire of the engine, substantially as described.

In testimony whereof I affix my signature in presence of witnesses.

BURT I. LAMB.

Witnesses:

W. R. PRUNER,
J. H. WILLIAMS,
LILLIE SARGENT.