Dec. 30, 1924.

1,521,187

S. JENCICK

INTERNAL COMBUSTION MOTOR STARTING APPARATUS

Filed Feb. 10, 1919 2 Sheets-Sheet 1

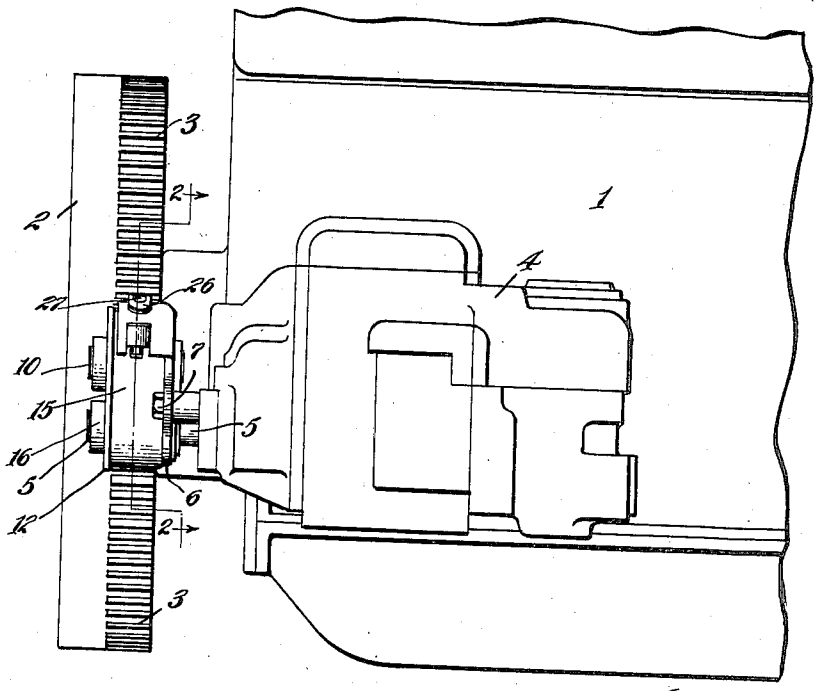


Fig. 1.

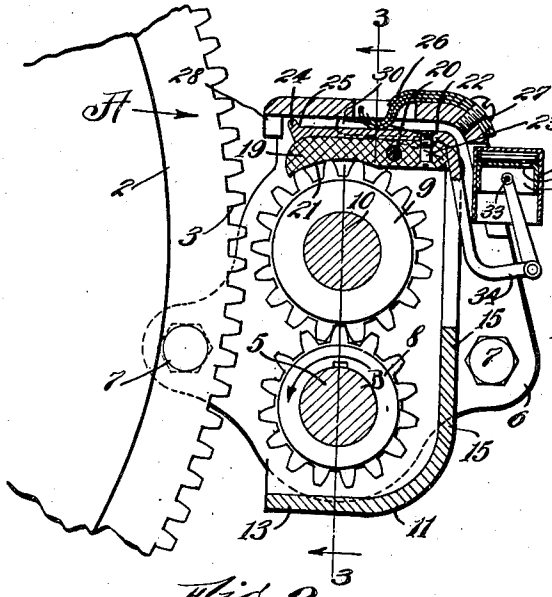


Fig. 2.

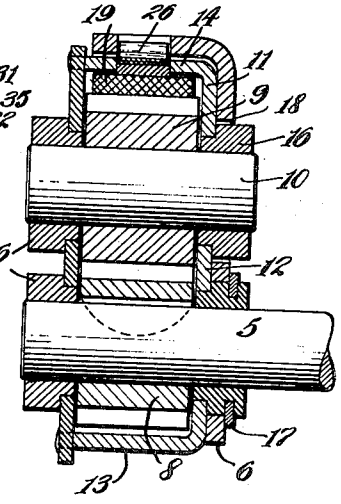


Fig. 3.

Inventor,
Stephen Jencick
by Brockett Hyde
Attys.

Dec. 30, 1924. 1,521,187

S. JENCICK

INTERNAL COMBUSTION MOTOR STARTING APPARATUS

Filed Feb. 10, 1919 2 Sheets-Sheet 2

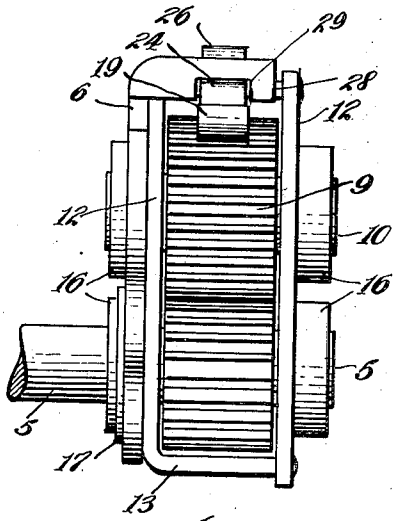


Fig. 4.

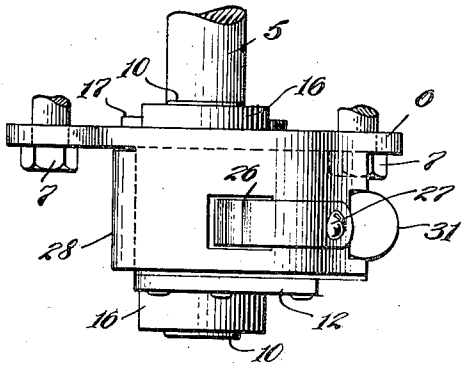


Fig. 5.

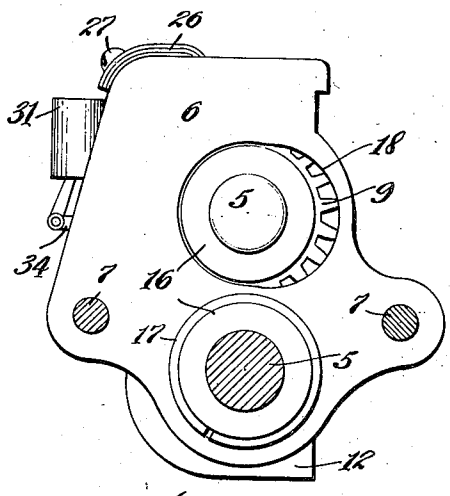


Fig. 6.

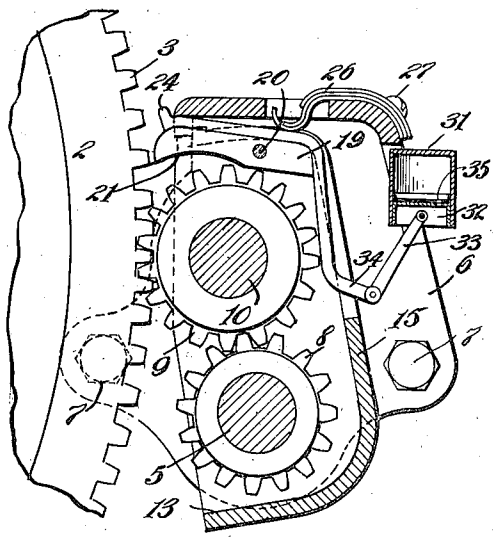


Fig. 7

Inventor,
Stephen Jencick
By Brockett & Hyde
Attys.

Patented Dec. 30, 1924. 1,521,187

UNITED STATES PATENT OFFICE.

STEPHEN JENCICK, OF CLEVELAND, OHIO, ASSIGNOR TO GUSTAVUS A. SCHANZE, OF CLEVELAND, OHIO; P. L. SCHANZE ADMINISTRATOR OF SAID G. A. SCHANZE, DECEASED.

INTERNAL-COMBUSTION-MOTOR-STARTING APPARATUS.

Application filed February 10, 1919. Serial No. 275,983.

To all whom it may concern:

Be it known that I, STEPHEN JENCICK, a subject of the Government of Austria, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Internal-Combustion-Motor-Starting Apparatus, of which the following is a specification.

This invention relates to starting devices for internal combustion engines, and more particularly to that general form of device which includes a driving wheel or gear rotated by the starting motor, and a co-operating driven wheel or gear having planetary movement around the driving gear into or out of meshing relation between the driving gear and a third wheel or gear connected to the internal combustion engine, this arrangement being such that the torque of the starting motor produces meshing or driving relation of the train of mechanism and the over-running action of the engine wheel or gear throws the train out of mesh.

The present invention has more particular relation to mechanism for securing more positive action of the gear train, and more specificially by producing a retarding effect upon the rotation of the driven wheel or gear in starting so that it has a positive tendency to travel into meshing or driving relation, the retarding effect being subsequently relieved so that the intermediate or driven wheel or gear is readily thrown out of meshing relation. The object of the invention, therefore, is to secure more positive control of the train of mechanism, to insure prompt driving engagement and release, and to avoid chatter of the wheels or gears when the engine is running under its own power.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings, which represent one suitable embodiment of the invention, Fig. 1 is a side elevation; Fig. 2 is a sectional elevation on the line 2—2, Fig. 1, the starting motor and internal combustion engine being omitted for simplicity of illustration; Fig. 3 is a sectional elevation on the line 3—3, Fig. 2; Fig. 4 is a detail end view of a portion of the mechanism viewed in the direction of the arrow A, Fig. 2; Fig. 5 is a top plan view of the device as shown in Fig. 4; Fig. 6 is a view similar to Fig. 2 but looking at the opposite side; and Fig. 7 is a view similar to Fig. 2 with parts in engaged position.

1 indicates the internal combustion engine to be started, which may be of any suitable or desired form, and whose crank shaft is provided with the usual fly wheel 2 having teeth 3 thereon such as are usually provided for operation by the starting mechanism. 4 indicates the starting motor or power source, which may be of any suitable form and is shown as an ordinary electric motor having a motor shaft 5.

6 indicates an outer frame or support for the starting mechanism. This frame is shown in the form of a plate having ear portions provided with openings arranged to receive bolts 7 for securing it to any suitable portion of the stationary frame, such as a portion of the frame of the motor 4 or engine 1, as may be desired. Shaft 5 extends through the plate 6 and beyond the same has keyed or otherwise secured to rotate therewith a primary driving pinion or gear 8, the periphery of which is in driving relation with the intermediate driven pinion or gear 9 carried by a stub shaft 10.

11 indicates a swinging box or frame having two opposite parallel walls 12, one at each end of the wheels 8 and 9, a bottom wall 13, and a roof or top wall 14. The outside of said box is closed by a vertical wall 15 while its inner side is open. In the side walls 12 of said box are rigidly secured a series of bearing members 16 for the shafts 5 and 10, four of said bearing members being illustrated in Fig. 3. The inner bearing member for the shaft 5 is held against end-wide movement in the frame 6 by a split washer 17 secured in an annular slot in said bearing member, while the wall of the frame 6 at the inner bearing member 16 for the shaft 10 is provided with a clearance space or slot 18 around the member 16 to permit swinging movement of the frame 11 within the frame 6 and around the shaft 5 as an axis.

During the starting operation the motor shaft 5 rotates in the direction of the

arrow B thereon, Fig. 2, and tends to and does swing the frame 11 in the counter-clockwise direction, until the pinion 9 is in meshing relation as an intermediate gear between gears 8 and 2, so that the starting motor turns the gear 2 and the driving torque maintains meshing relation of the gear train. When the engine 1 starts under its own power gear 9 is kicked or thrown out of its intermediate driving position.

The present invention includes suitable means for retarding the rotation of the driven pinion 9, relieving said retardation when the gear 9 is in action, and again producing retarding effect when the gear is thrown out of action. The means illustrated in the drawings include a friction shoe 19 pivoted at 20 between the parallel walls of the swinging box 11. Said shoe has its lower surface curved at 21 to fit the periphery or outer exposed surface of the teeth of gear 9 when in contact therewith. On the upper surface of said shoe is a metal strip 22 secured thereto by a screw 23 and having its inner end bent upwardly at 24 to form a tooth or projection, the surface of said projection away from the gear 3 preferably being slightly curved as at 25. Above said shoe, and preferably contacting with the metal strip 22 thereof is a pressure spring 26, shown as a leaf spring secured by a screw 27 to the stationary frame member 6. Said frame member adjacent tongue 24 is provided with a pair of downwardly extending projections 28, the space 29 between said projections being wide enough to allow the tongue 24 to pass therebetween. Said projections serve as an abutment which is engaged by a shoulder 30 on the swinging frame 11 to limit movement of the gear 9 toward meshing relation with the gear 3.

Fig. 2 illustrates the idle position of the parts, it being assumed that no parts are rotating in said view. The gear 9 is in its outer position away from or out of meshing relation with gear 3, but is, nevertheless, and always remains in meshing relation with the gear 8. Friction shoe 19 is held against the teeth of gear 9 by the pressure of spring 26, which is exerted at the left hand side of the pivot 20 in Fig. 2. If the starting motor 4 is now operated such as by supplying current and completing the circuits thereto, the shaft 5 begins to rotate in the direction of arrow B. The friction of the shoe 19 on gear 9 retards or prevents rotation of gear 9, so that the first tendency is for gear 9 and the swinging frame 11 by which it is carried to turn in the counter clockwise direction, Fig. 2, around shaft 5 as an axis. This motion continues until the shoulder 30 strikes the abutment 28, in which position full meshing relation between gears 9 and 3 is reached, but the teeth of the two gears are not tightly jammed together. After driving relation between the teeth of gears 9 and 3 is established, but before the frame 11 has swung to its limiting position, the pivot 20 of the friction shoe passes beyond the end of the spring 26, so that in the final position the pressure of said spring is exerted upon the friction shoe to the right of its pivot. The pressure of said spring therefore turns the shoe in the clockwise direction, Fig. 2, so as to move the same away from the teeth of gear 9. The same motion moves the tooth 24 upwardly past the edge of the fixed frame 6 to the position shown in Fig. 7, so that the engagement of said tooth with the fixed frame serves to positively lock or hold gear 9 in driving relation between gears 8 and 3. At the same time the driving torque of gears 8 and 3 maintains meshing relation.

Driving of the gear 3 and engine 1 by the starting motor 4 continues until finally engine 1 starts under its own power, whereupon gear 3 is suddenly rotated at an increased speed and its over-running effect throws or kicks the gear 9 out of driving relation. The curved surface 25 of the tooth 24 is so arranged that the outward pressure tending to push the frame 11 away will slightly depress the friction shoe 19 until the tooth 24 passes beneath the roof of the frame 6 and between the abutment members 28.

As the frame 11 is pushed outwardly by the over-running engine the pivot 20 of the friction shoe moves past the spring 26 until finally the pressure of said spring is again applied at the left of said pivot and again tends to move the shoe into frictional contact with the teeth of gear 9. Suitable means is preferably provided for retarding the approach of the friction shoe toward the teeth of gear 9, to allow the starting motor and the gears 8 and 9 driven thereby to come to rest before the friction shoe reaches full contact, it being understood, of course, that as soon as the engine picks up under its own power the current to the starting motor is cut off as is usual. In the construction shown in the drawings, this result is accomplished by connecting the friction shoe to a retarding device, such as a dash pot. 31 indicates a small cylinder carried by the stationary frame 6 and in which is a piston 32 connected by a link 33 to an arm 34 of the strip 22. Piston 32 may be provided with a small leak port 35 or may have sufficient leakage around said piston, so that the piston is allowed to gradually move toward the end of said cylinder. This dash pot permits only gradual seating motion of the friction shoe and therefore allows the starting mechanism to come to rest without liability of again producing retarding friction on the intermediate gear

and therefore again causing motion of said gear toward meshing relation with the gear 3.

What I claim is:—

1. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, means for retarding rotation of said intermediate pinion about its own axle to cause planetary movement thereof into meshing relation with said gear, and means for causing the release of said retarding means so as to permit free rotation of said intermediate pinion about its own axis upon being brought into mesh with said gear.

2. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, means for retarding rotation of said intermediate pinion about its own axis to cause planetary movement thereof into meshing relation with said gear, and means for rendering said retarding means ineffective when meshing relation is established.

3. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, friction means co-operating with said intermediate pinion tending to prevent its rotation and thereby produce movement thereof into meshing relation with said gear, and means for causing the release of said retarding means so as to permit free rotation of said intermediate pinion about its own axis upon being brought into mesh with said gear.

4. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, friction means co-operating with said intermediate pinion tending to prevent its rotation and thereby produce movement thereof into meshing relation with said gear, and means for reducing the frictional pressure of said friction means upon said intermediate pinion when meshing relation is established.

5. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, means for retarding rotation of said intermediate pinion about its own axis to thereby cause swinging motion of said frame and produce meshing relation between said intermediate pinion and gear, and means for rendering said retarding means effective or ineffective, according to the position of said frame.

6. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, means for retarding rotation of said intermediate pinion about its own axis to thereby cause swinging motion of said frame and produce meshing relation between said intermediate pinion and gear, and means controlled by the movement of said frame for rendering said retarding means ineffective.

7. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, means for retarding rotation of said intermediate pinion about its own axis to thereby cause swinging motion of said frame and produce meshing relation between said intermediate pinion and gear, means adapted when meshing relation is reached to render said retarding means ineffective, and means adapted upon disengagement of said intermediate pinion and gear to again render said retarding means effective.

8. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, means for retarding rotation of said intermediate pinion about its own axis to thereby cause swinging motion of said frame and produce meshing relation between said intermediate pinion and gear,

means adapted when meshing relation is reached to render said retarding means ineffective, means adapted upon disengagement of said intermediate pinion and gear to again render said retarding means effective, and means for delaying the operation thereof until said intermediate pinion substantially comes to rest.

9. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, a retarding device carried by said frame and operative upon said gear, and relatively stationary means for actuating said device.

10. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, a frame carrying said intermediate pinion and supported for oscillating movement about the axis of said shaft, a movable brake member carried by said frame and co-operating with said gear, and means rendered effective by movement of said frame for rendering said brake member effective or ineffective.

11. Starting mechanism for internal combustion motors, comprising a gear adapted to be driven by the motor, a starting shaft carrying a primary driving pinion, an intermediate pinion driven thereby and having planetary movement about the same into and out of mesh with said gear, means effective upon said primary and intermediate pinions and tending to prevent relative rolling motion therebetween to thereby cause planetary movement of said intermediate pinion into meshing relation with said gear, and means for causing the release of said retarding means so as to permit free rotation of said intermediate pinion about its own axis upon being brought into mesh with said gear.

In testimony whereof I affix my signature.

STEPHEN JENCICK.