

No. 881,069.

PATENTED MAR. 3, 1908.

H. P. FRANCIS,  
ENGINE STARTER.

APPLICATION FILED APR. 20, 1906.

4 SHEETS—SHEET 1.

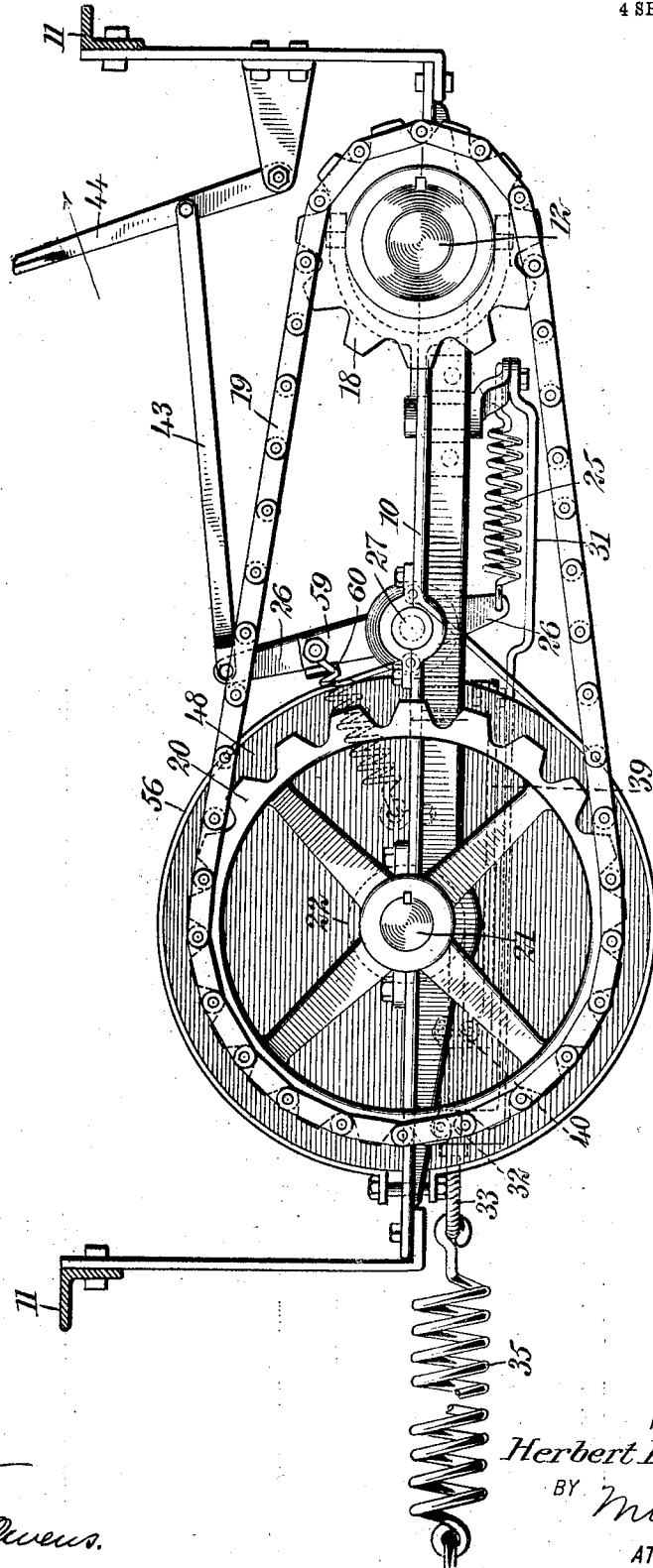


Fig. 1.

WITNESSES

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4 SHEETS—SHEET 3.

Fig. 3.

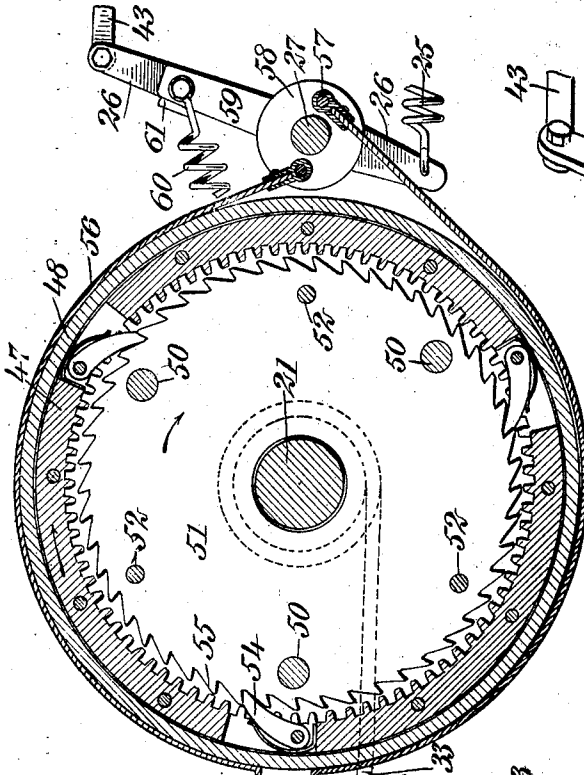


Fig. 2.

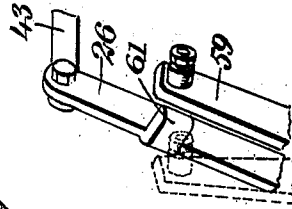


Fig. 4.

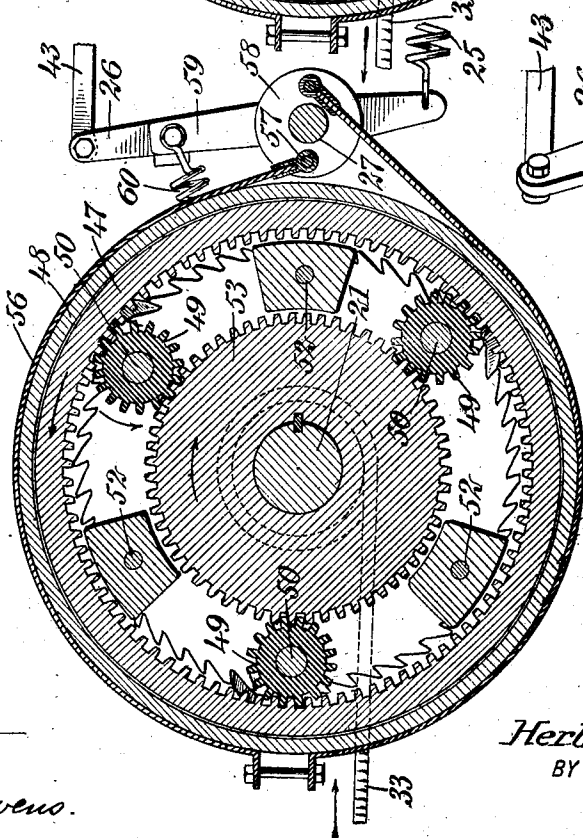
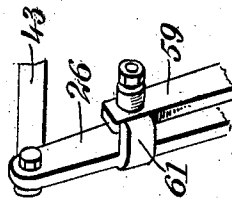


Fig. 7.



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4 SHEETS—SHEET 4.

Fig. 5.

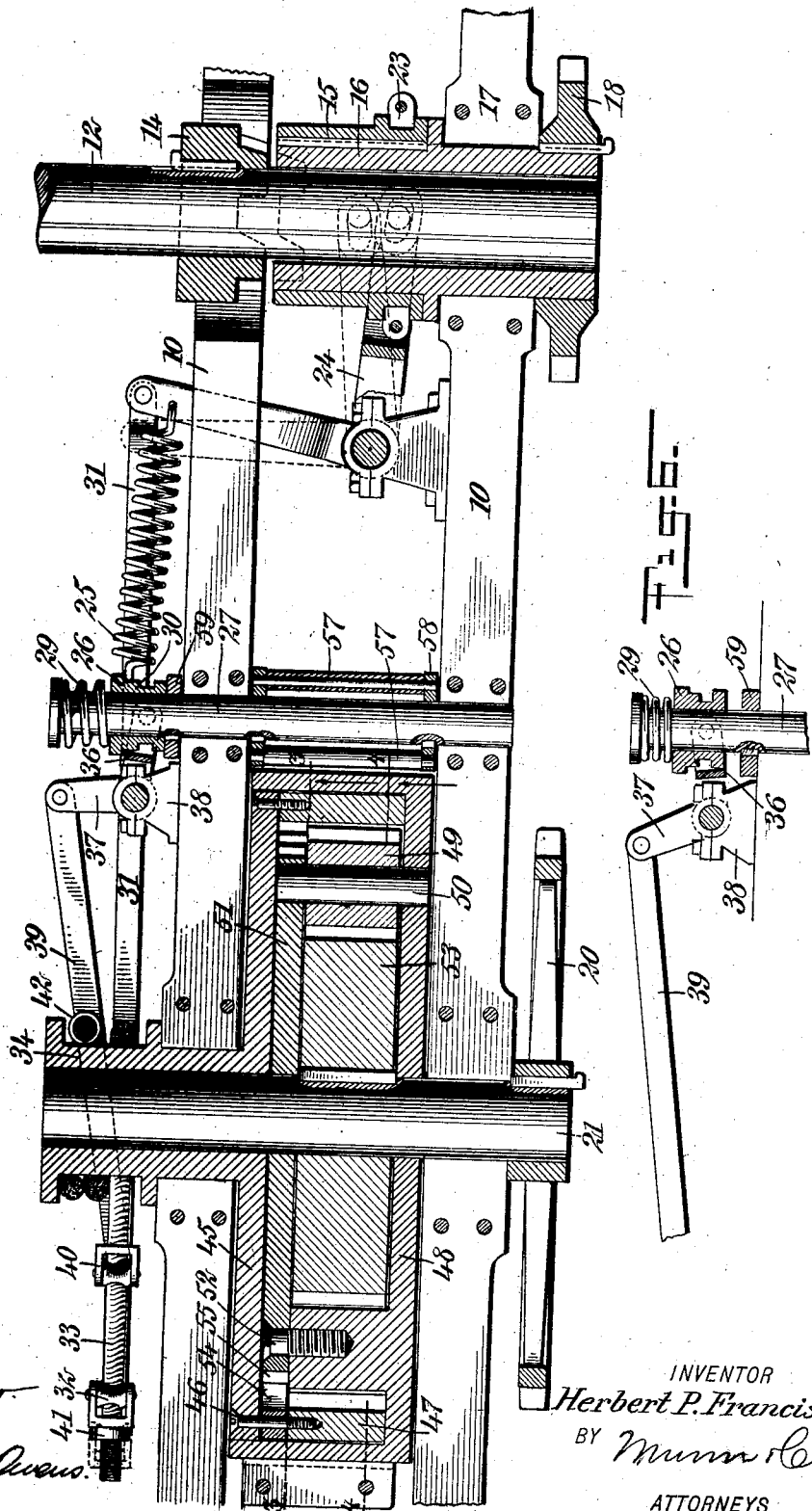


Fig. 6.

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# UNITED STATES PATENT OFFICE.

HERBERT PAUL FRANCIS, OF OROVILLE, CALIFORNIA.

## ENGINE-STARTER.

No. 881,069.

Specification of Letters Patent.

Patented March 3, 1908.

Application filed April 20, 1906. Serial No. 312,806.

*To all whom it may concern:*

Be it known that I, HERBERT PAUL FRANCIS, a citizen of the United States, and a resident of Oroville, in the county of Butte and State of California, have invented a new and Improved Engine- Starter, of which the following is a full, clear, and exact description.

The invention relates to an apparatus for starting engines, particularly internal combustion engines, and belongs to that class in which a spring or other means of storing energy is employed, the spring being wound by the normal operation of the engine and reversed to turn the engine when the same is to be started.

The special object of my invention is to render the action of the mechanism both in starting the engine, and in rewinding the spring as nearly automatic as possible, and I attain this end by certain special devices controlling the action of the starting spring, which devices themselves are entirely controlled by a single operating lever or other member.

Various other features of major or minor importance are involved, and all will be fully set forth hereinafter and particularly pointed out in the claims.

Reference is to be had to the accompanying drawings which illustrate as an example the preferred embodiment of my invention, in which drawings

Figure 1 is a front elevation of the starter; Fig. 2 is a plan view of the same; Fig. 3 is a section on the line 3—3 of Fig. 5; Fig. 4 is a section on the line 4—4 of Fig. 5; Fig. 5 is a horizontal section taken through the mechanism; Fig. 6 is a detail view showing the means for automatically releasing the brake which restrains the spring; and Figs. 7 and 8 are detail perspective views showing the co-action of the brake and clutch operating levers.

The frame 10 of the apparatus is preferably joined securely to the body of the engine, a part of which is illustrated at 11 in Figs. 1 and 2.

12 indicates the crank shaft of the engine to which the starting mechanism is connected. Fastened to the crank shaft is a clutch collar 14 with which coacts a clutch member 15 splined on a sleeve 16. This sleeve turns loosely around the engine shaft, and is mounted in a bearing 17 forming part of the frame 10. Said sleeve 16 carries a sprocket wheel 18, and over this a chain 19

runs to a sprocket wheel 20 secured to the shaft 21 revolubly carried in bearings 22 also forming part of the frame 10. A collar 23 loosely encircles the sleeve 16, and is engaged with one arm of an elbow lever 24, and with the other arm a retractile spring 25 is connected. This spring is joined to the lower end of a lever 26 which lever, as shown best in Fig. 1, is between its ends mounted loosely on a shaft 27 forming the fulcrum of the lever and carried in bearings 28 on the frame 10. The lever 26 is pressed inward toward the frame by a spring 29, and formed on the lever and surrounding the shaft 27 is a grooved collar 30. The elbow lever 24 is also connected with a reach rod 31 joined to the arm of the lever to which the spring 25 is connected, and this reach rod extends along the frame 10 to a point beyond the shaft 21, it being there provided with a runner 32 which loosely engages a cable 33. This cable is wound over a drum 34 which loosely embraces the shaft 21 and is mounted in one of the bearings 22 before described. To the other end of the cable 33 a starting spring 35 is joined. This spring is fastened to a suitable stationary part, and through the cable 33 and drum 34 exerts on the apparatus the power which is employed to start the engine, as will be fully set forth hereinafter.

The grooved collar 30 of the lever 26 is engaged by a fork 36 forming part of an elbow lever 37 suitably fulcrumed on a bracket 38 projecting from the frame 10. To said elbow lever 37 a link or reach rod 39 is joined, and this carries a runner 40 loosely engaging the cable 33 and similar to the runner 32, excepting that the two runners are arranged reversely on the cable, as best shown in Fig. 5. The runner 32 is adapted to be engaged by a button 41 fastened to the cable 33, while the runner 40 is adapted to be engaged by a button 42. It thus appears that the movement of the cable in one direction will actuate the reach rod 31, while the movement of the cable in the other direction will actuate the reach rod 39. The spring 25 normally holds the clutch member 15 engaged with the member 14, while the lever 26 controls the tension and, therefore, the action of said spring. The elbow lever 37, with its rod 39, and runner 40, controls the position of the lever 26 on the shaft 27 for a purpose which will fully appear hereinafter. To the upper end of the lever 26 a rod 43 is connected. This rod is in turn joined to a treadle or other

lever 44 which furnishes the means by which the action of the engine starter is controlled.

The drum 34 encircling the shaft 21 carries at its inner end a disk 45, and this in turn is fastened by screws 46 to an internal gear ring 47. This ring is loosely contained within a case 48, and meshed with said gear ring 47 are a number of pinions 49 carried loosely on shafts 50 which are mounted in the case 48 and also in a disk 51 contained in the case and connected thereto by means of the shafts 50, and also by means of screws or equivalent fastenings 52. The pinions 49 mesh with a spur gear 53 which is connected to the shaft 21 and located within the casing 48. The disk 45 of the drum 34 and the internal gear ring 47 carry a number of pawls 54, and these are in mesh with ratchet teeth 55 formed on the periphery of the before mentioned disk or wall 51. The case 48 is circular, as shown best in Figs. 3 and 4, and encircling the same is a brake band 56. The ends of said band are connected to pins 57 which in turn are held by disks 58 secured to the before mentioned shaft 27, so that by rocking the shaft the brake band may be applied to or disengaged from the case at will. Fastened to the shaft 27 alongside of the lever 26 is a lever arm 59, and to this arm a spring 60 is joined which tends to hold the brake band tight on the case 48. As shown best in Figs. 2, 4 and 3 the lever 26 is provided with a transverse lug 61, and this is adapted to engage the lever 59. When the parts are in the position shown in Fig. 2, said lug bears against the left hand side of the lever 59, which is to say the side removed from the engine shaft 12. The elbow lever 37, however, engaging the hub of the lever 36 is adapted upon the operation of the elbow lever to throw the hub 30 and the lever 26 outward away from the lever 59, thus disengaging the lug 61 therefrom and allowing disengagement of the lever, as will hereinafter fully appear.

In the operation of the invention, the clutch members 14 and 15 may be engaged, the spring 25 assisting in this operation, and during the movement of the engine the gear elements 18, 19 and 20 will cause the shaft 21 to be rotated. The brake band 56 being applied to the case 48 will hold the same stationary, and the shaft 21 through the gears 53, 49 and 47 and disk 45 will impart rotating movement to the drum 34; winding the cable thereon and placing the spring 35 under tension. This operation continues until the button 41 strikes the runner 32 whereupon the reach rod 31 will be operated to throw the lever 24 and disengage the clutch 15 from the clutch member 14. Meanwhile the spring 60 will continue active, thus keeping the brake band 56 in operation. When it is desired to start the engine the operator need only to throw the treadle lever 44 in the direction of the arrow indicated in

Fig. 1, which will swing over the levers 26 and 59, causing the brake band 56 to relax its hold on the case 48 and also causing the elbow lever 24 through the medium of the spring 25 to reengage the clutch members 14 and 15. The tension of the spring exerted on the drum 34 through the medium of the cable 33 will cause said drum and the disk 45 to turn, carrying with it the gear 47, and since the pressure of the brake strap on the case 48 is relaxed the case, with the pinions 49, will turn bodily with the drum 34, the pawls 54 acting against the ratchet teeth 55 to accomplish this end, and in this manner the gear 53 and shaft 21 are rotated, rotating the engine shaft 12 through the medium of elements 20, 19, 18, 16, 15 and 14. In this manner the engine shaft is rotated to start the engine, and the above described movement of the parts continues as long as pressure is exerted on the lever 44. As soon as this pressure is relaxed the spring 60 returns the lever 59 so as to apply the brake to the case 48, and also acting through the medium of the lug 61 returns the lever 26 to disengage the clutch members 14 and 15. The number of turns which are given to the engine shaft by this operation may be controlled readily by the ratio of the gearing involved. As the apparatus becomes unwound or approaches this condition, the button 42 will strike the runner 40 acting on the same to move the reach rod 39, and through the elbow lever 37 moving the lever 26 outward to disengage the lug 61 from the lever 59. Fig. 6 shows the position of the parts at this time. The result of this operation is that the spring 60 is permitted to continue its action holding the brake band 56 applied to the case 48, and also the spring 25 is allowed to act to throw the clutch members 15 and 14 into engagement with each other. The engine having been started will through the medium of the gears 18, 19 and 20 impart to the shaft 21 a rotating motion, and this shaft acting through the gears 53, 49, 47 and disk 45 will impart to the drum 34 a winding movement which will rewind the cable 33 on the drum, this rewinding action continuing until the button 41 strikes the guide 32 again disengaging the clutch members 14 and 15 and swinging leftward the upper end of the lever 26, referring to Fig. 1. As soon as the before described rewinding of the cable 33 begins the button 42 will disengage the runner 40 and the spring 25 will be permitted to return the lever 26 to its normal position, said lever retaining the position shown in Fig. 6 only during the time that the button is engaged with the runner.

It will thus appear that the apparatus is normally wound ready for operation, that this operation may be brought about instantly and at any time by the mere movement of the lever 44, and that as the appa-

ratus reaches a point at or near the unwound position it is immediately and automatically rewound, and the winding operation automatically checked as soon as completed. It will also appear that the starting movement under the rewinding action of the spring and cable is transmitted through the rotation of the case and gears bodily, the brake straps being relaxed while the rewinding motion is transmitted by the interaction of the gears 47, 49 and 53, the case 48 then being held stationary by the brake to allow the pinions 49 to rotate around their axles 50, the action of the brake strap as well as of the clutch on the crank shaft of the engine being controlled automatically from the buttons and runners on the cable.

Having thus described the preferred form of my invention, what I actually claim and desire to secure by Letters Patent is:

1. In an engine starter, the combination of a means for storing energy, a rotary shaft, means connecting it to the engine, a gear in connection with said means for storing energy, a gear in connection with the shaft, an independently rotatable member, a gear carried thereby, and means for arresting the movement of said independently rotatable member at will, said means being automatically controlled by the means for storing energy.

2. In an engine starter, the combination of a means for storing energy, a rotary shaft, means connecting it to the engine, a gear in connection with said means for storing energy, a gear in connection with the shaft, an independently rotatable member, a gear carried thereby, means for arresting the movement of said independently rotatable member at will, said means being automatically controlled by the means for storing energy, and a manually operative device also in connection with the means for arresting the movement of the independently rotatable member.

3. In an engine starter, the combination of a means for storing energy, a rotary shaft, means including a clutch for connecting the shaft to the engine, a gear connected to the shaft, a gear connected to the means for storing energy, an independently rotatable member, a brake therefor, a gear mounted on said independently rotative member and meshed with the first named gears, and devices for actuating the clutch and brake.

4. In an engine starter, the combination of a means for storing energy, a rotary shaft, means including a clutch for connecting the shaft to the engine, a gear connected to the shaft, a gear connected to the means for storing energy, an independently rotatable member, a brake therefor, a gear mounted on said independently rotative member and meshed with the first named gears, and devices for actuating the clutch and brake,

said devices being actuated from said means for storing energy.

5. In an engine starter, the combination of a means for storing energy, a rotary shaft, means including a clutch for connecting the shaft to the engine, a gear connected to the shaft, a gear connected to the means for storing energy, an independently rotatable member, a brake therefor, a gear mounted on said independently rotative member and meshed with the first named gears, devices for actuating the clutch and brake, said devices being actuated from said means for storing energy, and a manually operative means also for actuating the clutch and brake.

6. In an engine starter, the combination of a means for storing energy, a rotary shaft, means including a clutch for connecting the shaft to the engine, a gear connected to the shaft, a gear connected to the means for storing energy, an independently rotatable member, a brake therefor, a gear mounted on said independently rotative member and meshed with the first named gears, devices for actuating the clutch and brake, and means for causing said independently rotative member to turn with the gear connected to the means for storing energy.

7. In an engine starter, the combination of a means for mechanically storing energy, a cable connected thereto, a drum on which the cable is wound, a gear connected to the drum, a rotary shaft, a gear connected thereto, a rotary case, a gear mounted thereon and meshed with the two first named gears, a brake for the case, means for causing the case to turn with the gear connected to the drum when said gear turns in one direction, means for operating the brake, and means connecting the shaft with the engine.

8. In an engine starter, the combination of a means for mechanically storing energy, a cable connected thereto, a drum on which the cable is wound, a gear connected to the drum, a rotary shaft, a gear connected thereto, a rotary case, a gear mounted thereon and meshed with the two first named gears, a brake for the case, means for causing the case to turn with the gear connected to the drum when said gear turns in one direction, means for operating the brake, and means connecting the shaft with the engine, the last named means including a clutch and operating devices in connection with the means for operating the brake.

9. In an engine starter, the combination of a means for mechanically storing energy, a cable connected thereto, a drum on which the cable is wound, a gear connected to the drum, a rotary shaft, a gear connected thereto, a rotary case, a gear mounted thereon and meshed with the two first named gears, a brake for the case, means for causing the case to turn with the gear connected to the drum when said gear turns in one direction,

means for operating the brake, and means connecting the shaft with the engine, said means for operating the brake being actuated from the cable.

5 10. In an engine starter, the combination  
of a means for mechanically storing energy,  
a cable connected thereto, a drum on which  
the cable is wound, a gear connected to the  
10 drum, a rotary shaft, a gear connected there-  
to, a rotary case, a gear mounted thereon  
and meshed with the two first named gears,  
a brake for the case, means for causing the  
case to turn with the gear connected to the  
15 drum when said gear turns in one direction,  
means for operating the brake, means connect-  
ing the shaft with the engine including  
a clutch, and means for actuating said clutch  
and brake operating means from the cable.

20 11. In an engine starter, the combination  
of a means for mechanically storing energy,  
a cable connected thereto, a drum over which  
the cable is wound, an internal gear con-  
nected to the drum, a gear case, a gear carried  
thereby and meshed with the internal gear,  
25 means for causing the gear case to turn with  
the internal gear in one direction, a rotary  
shaft on which the case turns loosely, a gear  
fastened to the shaft within the case and  
meshed with the second named gear, a brake  
30 for the gear case, and means connecting the  
shaft with the engine.

35 12. In an engine starter, the combination  
of a means for mechanically storing energy,  
a cable connected thereto, a drum over which  
the cable is wound, an internal gear con-

nected to the drum, a gear case, a gear carried  
thereby and meshed with the internal gear,  
means for causing the gear case to turn with  
the internal gear in one direction, a rotary  
shaft on which the case turns loosely, a gear  
40 fastened to the shaft within the case and  
meshed with the second named gear, a brake  
for the gear case, means connecting the shaft  
with the engine including a clutch, and means  
for operating the clutch and brake. 45

13. In an engine starter, the combination  
of a means for mechanically storing energy,  
a cable connected thereto, a drum over which  
the cable is wound, an internal gear con-  
50 nected to the drum, a gear case, a gear carried  
thereby and meshed with the internal gear,  
means for causing the gear case to turn with  
the internal gear in one direction, a rotary  
shaft on which the case turns loosely, a gear  
55 fastened to the shaft within the case and  
meshed with the second named gear, a brake  
for the gear case, means connecting the shaft  
with the engine including a clutch, means for  
operating the clutch and brake comprising  
60 devices automatically operated from the  
cable, and a manually operated device in  
addition thereto.

In testimony whereof I have signed my  
name to this specification in the presence of  
two subscribing witnesses.

HERBERT PAUL FRANCIS.

Witnesses:

R. E. ROBINSON,  
R. SAVILLE.