F. RICHARD.

STARTING APPLIANCE.

APPLICATION FILED FEB. 3, 1917.

1,331,168.

Patented Feb. 17, 1920.

3 SHEETS—SHEET 1.

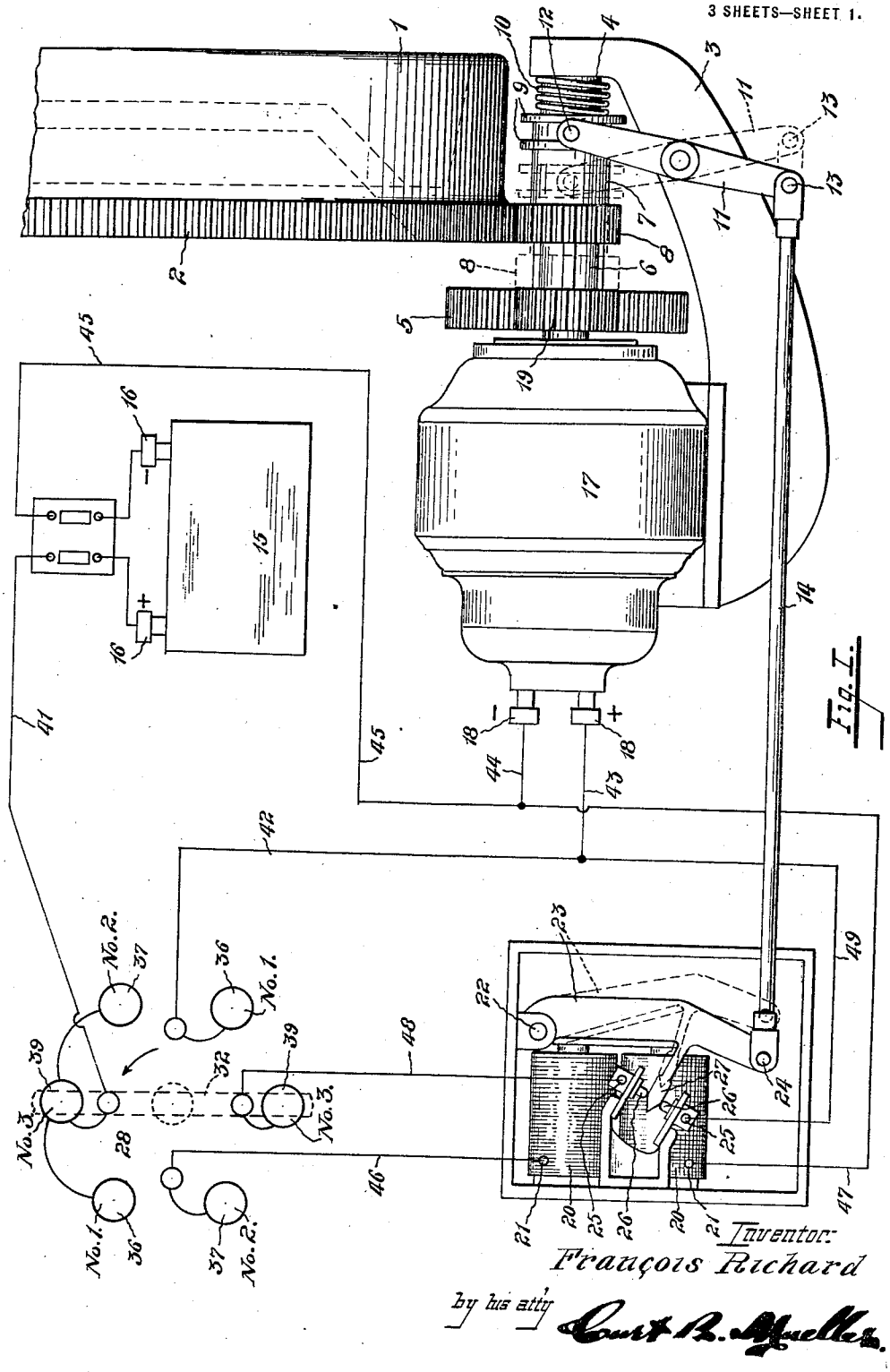


Fig. 1.

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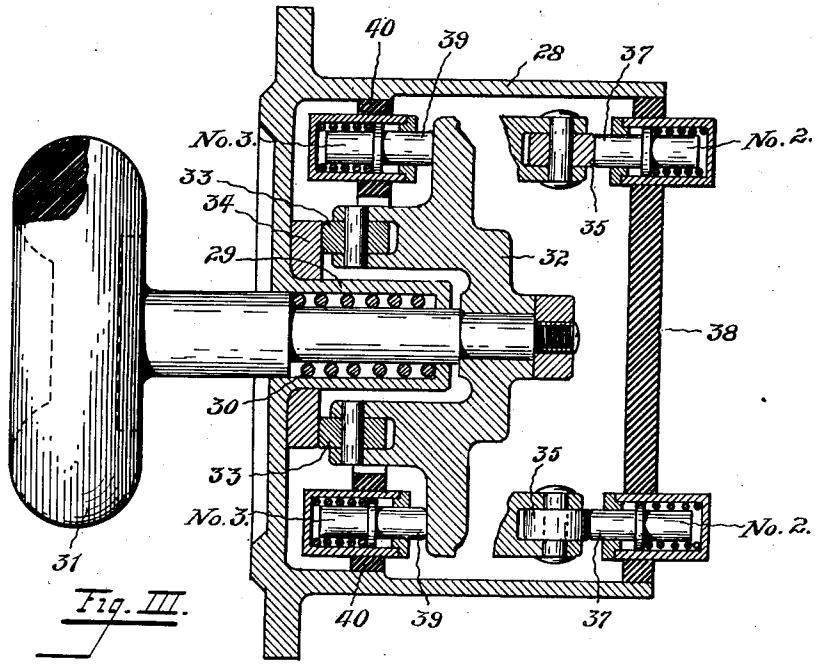


Fig. III.

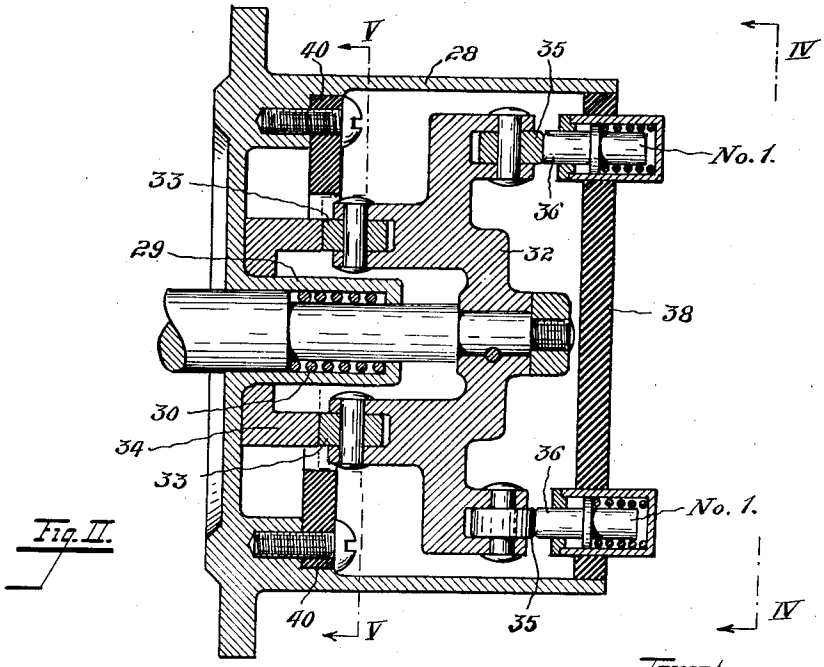


Fig. II.

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3 SHEETS—SHEET 3.

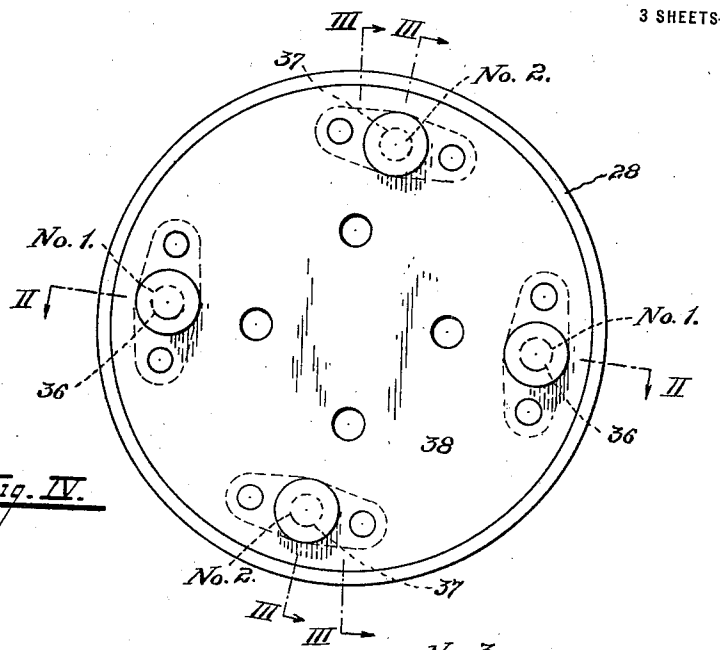


Fig. IV.

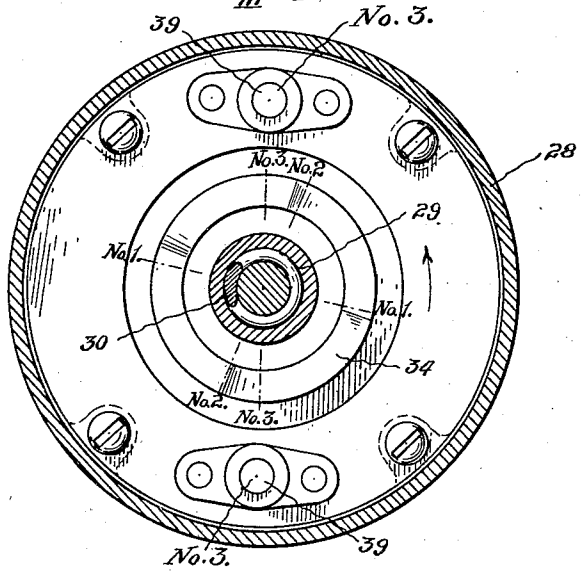


Fig. V.

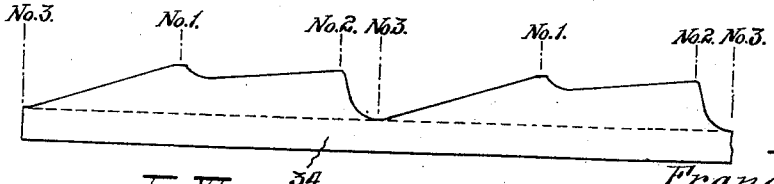


Fig. VI.

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UNITED STATES PATENT OFFICE.

FRANÇOIS RICHARD, OF CLEVELAND, OHIO, ASSIGNOR TO THE RICHARD AUTO MFG. COMPANY, OF CLEVELAND, OHIO.

STARTING APPLIANCE.

1,331,168. Specification of Letters Patent. Patented Feb. 17, 1920.

Application filed February 3, 1917. Serial No. 146,495.

To all whom it may concern:

Be it known that I, FRANÇOIS RICHARD, a citizen of the Republic of France, residing at city of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Starting Appliances, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My present invention pertains to a starting appliance and more particularly to an electrically connected system suited for starting a hydrocarbon motor. As exemplified in the drawings the same is shown adapted for use in conjunction with the fly wheel of an automobile engine and employing a starting pinion which is reciprocable into and out of mesh with such wheel.

Experience has taught that the order and timing of the two distinct movements of a starting pinion are important from the viewpoint both of efficiency and durability. It is also desirable to facilitate the control and to eliminate the possibility of improper operation of the parts of the starting agency during successive stages of its actuation.

The object of my invention besides contriving a feasible, durable and sufficiently economical arrangement, is to supply an intermittent power impulse to the starting pinion or have the motor which drives it do so at separated intervals. Between times, while the pinion is still revolving idly, a magnet is energized to enable its armature to draw the pinion into mesh with the fly wheel. Thereafter the motor is again caused to drive the pinion at the same time breaking the circuit to the magnet so that when the engine starts a spring acts to slip the pinion out of mesh. A further object has been to devise a multiple contact manually operable switch which will be strong, compact in build, positive in action and require a short range of movement with little effort. This switch is located on the dash or instrument board together with other controls and thus obviates the likelihood of untimely operation of the starting appliance while the engine is running.

With the foregoing and other objects in view the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which come within the scope of the claim hereunto appended.

Adverting to the drawings:

Figure I is a diagrammatic view of a complete electrical system embodying the features of my invention in association with the fly wheel of an automobile engine.

Fig. II is a section through the switch box by means of which my starting appliance may be controlled and showing the coacting parts in what I term the first position.

Fig. III illustrates two distinct sections through the switch box each taken on a plane at an angle to the section on which Fig. II is taken and showing the parts in what will hereinafter be spoken of as the second and third positions respectively.

Fig. IV is an elevation of that side of the switch box which is farthest from the operator taken on line IV—IV of Fig. II looking in the direction of the indicating arrows.

Fig. V is a section on line V—V of Fig. II and is relatively transverse to the sectional planes on which Figs. II and III are taken.

Fig. VI is a developed view of a circular cam constituting one detail of the switch operating mechanism according to the exemplification here selected.

I have already stated three positions which my control switch is enabled to assume and it may be well to premise further at this point by mentioning that my idea comprehends a convenient location of the switch control, such as on the instrument board of an automobile, and an arrangement whereby a half turn of the handle which is to be manipulated causes the switch member proper to successively assume the three distinct effective positions in each of which an electrical current is closed.

The first position spins a motor and a starting pinion, while the latter is out of engagement with the gear teeth on the fly wheel of the engine.

The second position closes a distinct circuit to energize an electromagnet to actuate its armature and thereby pull the starting pinion into mesh with the fly wheel prior to

the closing of the circuit of which the switch member during such second position is a part. Meanwhile the circuit which was closed by the first position has become broken so that the starting pinion is not being positively driven when drawn into mesh with the teeth on the fly wheel.

The third position again permits current to pass through the motor thus revolving the starting pinion and consequently the fly wheel of the engine until the latter starts.

The position of the parts as illustrated in the diagrammatic view in Fig. I is just after the third position and while the motor is still turning the engine over, but before the engine has started. Thereafter the fly wheel will run faster than the starting pinion to remove the pressure from it whereupon suitable mechanism including a return spring is permitted to shift the pinion out of mesh with the fly wheel and at the same time break the circuit to throw the current off of the motor.

In Fig. I a portion of the fly wheel 1 of an engine is shown provided with gear teeth 2. Fixedly mounted near the fly wheel is a supporting bracket 3 having an extension in which a shaft 4 is rotatably mounted. Keyed to such shaft near one end is a gear 5. The shaft is formed with a quadruple spline 6 and carries a sleeve 7 formed at one end as a pinion 8 and at the other end with a pair of spaced collars 9. Interposed between the sleeve 6 and the bracket 3 about the shaft bearing, is a releasing spring 10. Pivoted to the bracket 3 is a shifting lever 11 having its one end articulating with the sleeve 7 by the interpositioning of fingers 12 between the collars 9. The other end of the lever 11 articulates at 13 with a rod 14, the purpose of which will be later described. The arrangement so far described should be assumed to be such that the pinion 8 is adapted to slide along the spline 6 into or out of mesh with the gear teeth 2 as suggested by the alternative dotted position of the pinion.

The electrical system includes a battery 15 as the source of current having the positive and negative poles 16. It also includes a starting motor 17 having terminals 18 and a shaft upon which a driving gear 19 is mounted so as to mesh with the gear 5 and at intervals rotate the shaft 4 and pinion 8. The electrical system furthermore includes a double coil electromagnet 20 having terminals 21. Pivoted upon a fixed point 22 is an armature 23 which has its free end articulating at 24 with the rod 14. It is therefore apparent that any movement on the part of the armature 23 will be transmitted to the rod 14 and hence to the lever 11 whereby to shift the sleeve 6 as already suggested. Fixed within the range of movement of the armature 23 are a pair of terminals 25 leading to contacts 26 between which latter an extension 27 from the armature is adapted to move so that each is frictionally engaged thereby.

A switch box 28 is provided and for following the description thereof attention is invited to Figs. II and III. It will there be seen to be provided with a hollow inward extension 29 in which a compression spring 30 is positioned through which the stem of a handle 31 projects to carry on its innermost extremity a switch member proper 32. The latter carries on the side toward the handle a pair of diametrically opposite rollers 33 adapted to ride around a circular cam 34 of the duplex configuration shown in Fig. VI. As will be readily understood when rotary movement is imparted to the handle 31, and in consequence to the switch member 32 which is keyed thereto, as appears in Fig. II, the latter will be reciprocated back and forth within the switch box 28 according to the contour of the cam. The switch member 32 is also provided on the side which is presented in a direction away from the handle 31 with another pair of rollers 35, and these are positioned a greater radial distance from the axis of the switch than the rollers 33, as will be evident upon inspection of either Figs. II or III. That side of the switch box 28 which is opposite to the side through which the stem of the handle 31 extends is provided with a pair of yieldingly mounted diametrically opposite contacts 36 corresponding to position No. 1 and also with another pair of yieldingly opposite pair of contacts 37, corresponding to position No. 2. Both of these pairs of contacts are insulated by means of fiber 38. The number of degrees by which the lines extending between the contacts 36 and the contacts 37 respectively are separated may be best seen in Fig. IV. As to radial distance from the axis they are, however, alike and so located as to be successively engaged in pairs by the rollers 35 in accordance with the contour of the cam, which will be presumed suited the accomplishment of such a successive engagement. The switch member 32, on its other side but at a corresponding distance from its center, is adapted to engage with still another pair of yieldingly mounted contacts 39 and the engagement of the switch member therewith will correspond to position No. 3. The contacts 39 are likewise surrounded by fiber insulation 40.

The connections between the several units of the electrical system, starting from the positive pole of the battery and tracing the three distinct circuits in the order in which they will become successively closed, comprise for the first position a wire 41 leading to one terminal of each of the three positions, a wire 42 leading from a terminal

of contact of position No. 1, a wire 43 leading into the motor, a wire 44 leading out of the motor and a wire 45 leading back to the negative pole of the battery. The circuit corresponding to the second position likewise includes the wire 41, the wire 46 connecting one terminal of the second position with one of the terminals 21 of the magnet, and a wire 47 connecting the other terminal of the magnet with the wire 45 and thence back to the battery. The circuit corresponding to the third position again includes the wire 41, a wire 48 extending from a terminal of the third position to one of the terminals 25 and a wire 49 connecting the other terminal 25 with the wire 43 and thence through the motor and along the wires 44 and 45 to return to the battery.

Preparatory to an explanation of the operation, a consideration of the relation of the parts as appears in Fig. I discloses that the magnet 20 is at the moment not energized. Therefore, as soon as the engine starts and thus removes the driving tension from the pinion 8 no force exists which will hinder either the tendency of the releasing spring 10 to expand and thereby shift the pinion 8 out of mesh with the fly wheel and into the position shown in dotted lines and hinder the simultaneous withdrawal of the extension 27 from between the contacts 26 so that the armature lever assumes its other position, which is likewise indicated in dotted lines. After the engine has come to rest and it is desired to again start the same the handle 31 may be given another rapid one-half turn to effect the following cycle of results. In its movement from position 3 to position 1 the switch member 32 will engage the contacts 36 by reason of the rollers 33 riding up the incline which the cam provides between positions 3 and 1. At the moment that such contact is established an electric circuit is closed from the battery along wire 41, along wire 42, wire 43, through the motor and out along wires 44 and 45 to return to the battery. The closing of such circuit momentarily spins the motor and therefore idly revolves the starting pinion 8. As the switch member 32 continues around it momentarily takes the position where it is closing no circuit whatever but almost immediately rises over the second cam inclination to presently engage with the contacts 37 and close the circuit, which may be traced from the battery along the wire 41 across to the wire 46 and through the magnet to the wire 47 and back to the battery along the wire 45. As the magnet is energized it promptly draws the armature lever 23 toward itself and thereby places the extension 27 between the contacts 26 and with the same movement oscillates the lever 11 to shift the pinion 8, which will still be revolving, into mesh with the teeth in the fly wheel.

During the completion or third stage, of the half turn of the switch member 32 the spring 30 is enabled to expend energy tending to draw the member 32 in a direction away from the plane of the contact 36 and 37, so that it is enabled to presently rub the contacts 39, thereby closing the circuit which corresponds to the third position and which may be traced from the battery along the wire 41 across to the wire 48, across the contacts 26 which are now connected by the extension 27 and thence along the wire 49 to the wire 43 through the motor and out along the wires 44 and 45 to return to the battery. As will now be apparent the starting pinion is alternately revolved and slid in a direction parallel to its axis, and its successive actuations are due to separate impulses each of which ceases at the proper time.

I claim:

A starting appliance comprising a revoluble and reciprocable pinion adapted operatively to engage with a toothed part of the engine to be started, and an electrical system for actuating said pinion and including; a source of current, a motor adapted to revolve said pinion, an electromagnet provided with contacts and an armature connected with said pinion for moving it in one direction of its reciprocal movement, said armature having an angular extension adapted to engage both contacts, mechanism including a spring arranged to withdraw said extension of said armature from its contact engaging position, a multiple contact switch, and connections whereby different circuit closing positions of said switch alternately place said motor and magnet singly in series with the source of current.

Signed by me, this 31st day of January, 1917.

FRANÇOIS RICHARD.