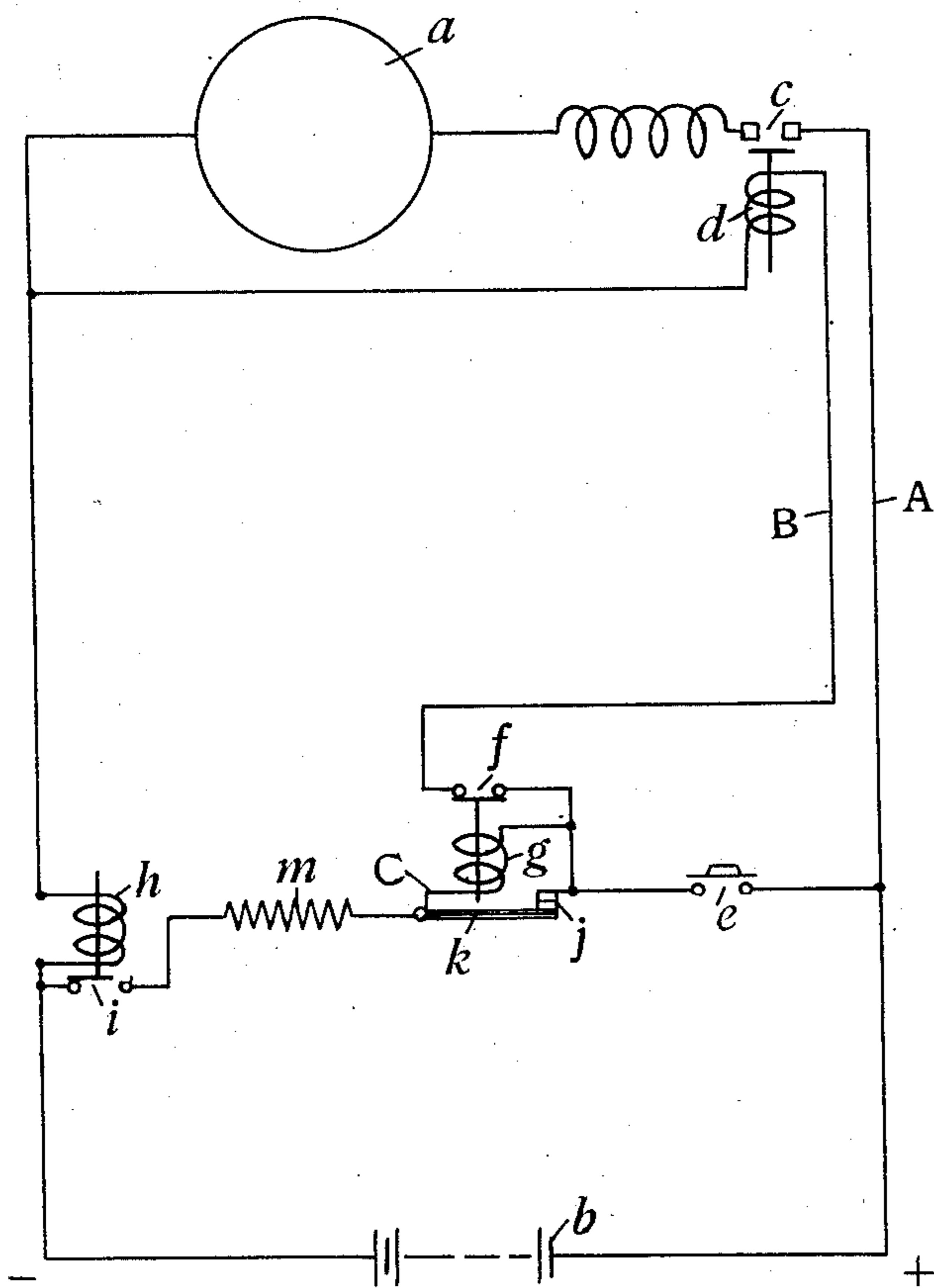


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ENGINE STARTING MECHANISM

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ENGINE STARTING MECHANISM

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1 Claim. (Cl. 175—375)

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This invention relates to starting mechanisms for vehicle and other internal combustion engines, of the kind in which an electric motor supplied with current from a battery is connectible with a gear wheel on the engine by an electromagnetically actuated slidable pinion, the object of the invention being to provide improved means for controlling such a mechanism.

The invention comprises the combination of an electromagnetic starting switch, a manually operable switch controlling the starting switch, an electromagnetic switch controlling the starting and manually operable switches, a time switch controlling the latter electromagnetic switch, and an electromagnetic switch dependent on current supplied to the motor for controlling the time switch, the arrangement being such that the last named electromagnetic switch causes the time switch to become operative only after the engine has been properly started.

The accompanying diagram illustrates one embodiment of the invention.

Referring to the diagram, the engine starting motor is indicated by *a*. This is supplied with current from a battery *b* under the control of a starting switch *c* operable by an electromagnet *d*. The motor *a*, battery *b*, and starting switch *c* are arranged in a main electric circuit *A*. The electromagnet *d* is arranged in a parallel circuit *B* which is connected to the main circuit *A* and contains a push-button or otherwise manually operable switch *e*, and a normally closed switch *f* operable by an electromagnet *g*.

In series with the motor and battery there is arranged in the main circuit *A* the winding *h* of a normally closed electromagnetic switch *i*. This switch is so designed that it is held open by the current normally required to operate the motor for starting the engine, and is allowed to re-close under the action of a spring when that current falls below a predetermined value as a consequence of the engine having been properly started. The switch *i* controls the circuit of a time switch *j*. In the example illustrated by the diagram the time switch *j* comprises a pair of normally closed contacts arranged in series with the switch *i* and the part of the circuit containing the switch *e* as shown, so that the switches *j*, *i* are connectible across the main circuit *A* by the switch *e*. One of the contacts of the switch *j* is carried or actuated by a bi-metal strip *k* adapted to separate the contacts after an appropriate interval of heating (say one second) by the current flowing through it. The switch *j* is bridged by a branch circuit *C* containing the

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electromagnet *g* above mentioned which serves to open the switch *f* and also to hold open the contacts *j* which are initially separated by the bi-metal strip *k*. The amount of current supplied to the circuit of the time switch is controlled by a resistance *m*.

The parts above described are interconnected in the manner shown by the diagram, and the mode of action of the system is as follows:

When the driver closes his switch *e* the associated switch *c* is closed by the electromagnet *d*. Current now flows from the battery to the motor causing the motor to be engaged with the engine and rotated. The amount of this current is such that it causes the switch *i* to be opened, thereby preventing premature actuation of the time switch *j*. Should a momentary firing occur in the engine, the motor current may fall in value sufficient to allow the said switch to close, but this is of no consequence, as the time switch will not respond to a momentary drop in the motor current, or a succession of such drops of short duration. When however, the engine has been properly started the motor current will not only drop but will remain steady at its lower value, and the switch *i* which is actuated by this current will not only close but remain closed. The time switch *j* then comes into action after an appropriate time interval, causing the switch *f* to be opened, thereby opening the circuit *B* containing the electromagnet *d* which in turn allows the switch *c* to open the circuit *A*. The supply of current to the motor is thereby interrupted. When the driver releases his switch *e*, the system resumes its initial condition.

By this invention we are able advantageously to simplify engine starting mechanisms of the kind specified. The invention is not, however, restricted to the example described, as subordinate details may be modified to suit different requirements.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

A control system for a starting mechanism of the kind specified, comprising in combination a main electric circuit, a normally open electromagnetic starting switch in said circuit, a parallel circuit connected to said main electric circuit, electromagnetically operable means responsive to current in said parallel circuit for closing said starting switch, a normally open manually operable switch and a normally closed electromagnetic switch arranged in series with each other in said parallel circuit, a normally closed

time switch and a second normally closed electromagnetic switch arranged in series with each other and connectible across said main circuit by said manually operable switch, a branch circuit bridging said time switch, electromagnetically operable means responsive to current in said branch circuit for opening the first mentioned normally closed electromagnetic switch when said time switch opens, and for retaining said time switch in its open position, and electromagnetically operable means responsive to current in said main electric circuit for opening said second normally closed electromagnetic switch when the flow of current in said main electric circuit exceeds a predetermined amount, and thereafter allowing reclosure of said second normally closed electromagnetic switch to permit current flow through said time switch only when the current in said main circuit falls below said amount.

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