June 28, 1938. E. A. STARK 2,122,049

SAFETY DEVICE

Filed April 18, 1936 2 Sheets-Sheet 1

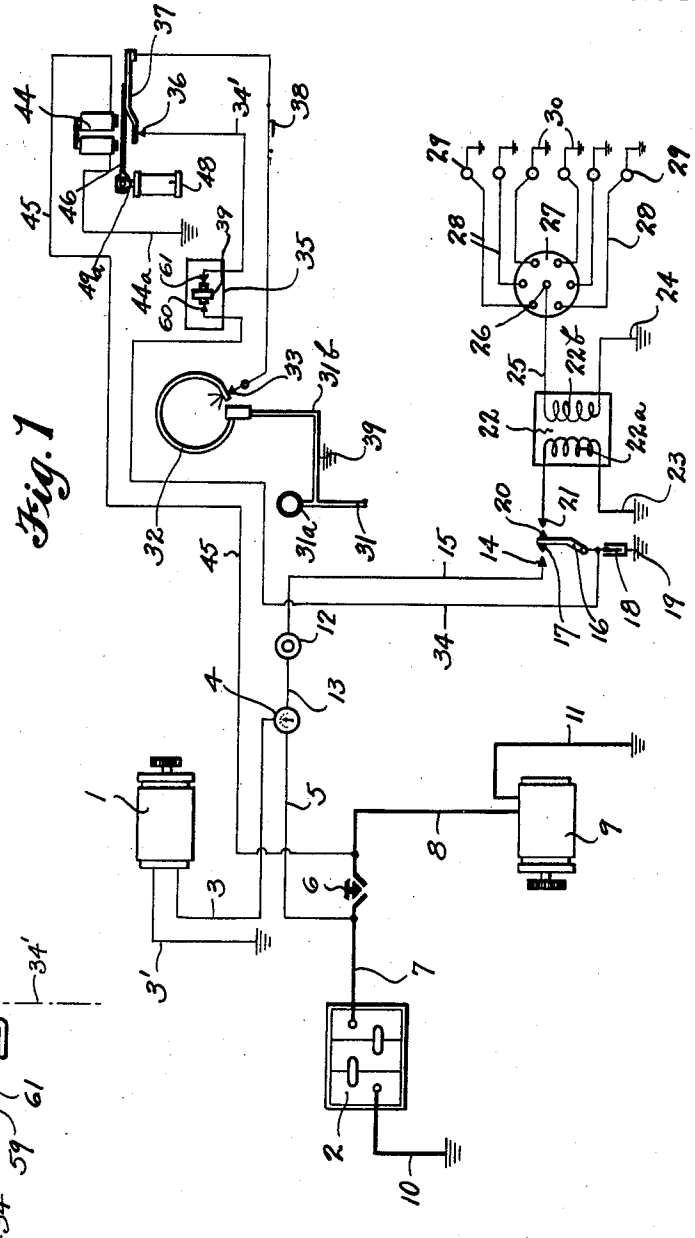


Fig. 1

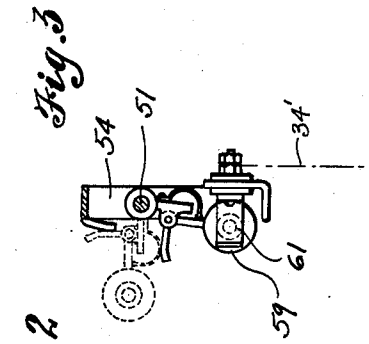


Fig. 3

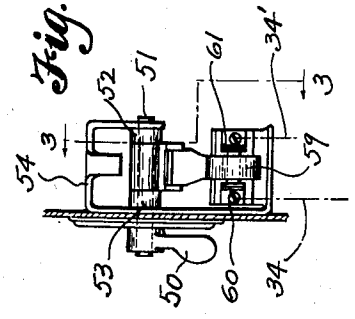


Fig. 2

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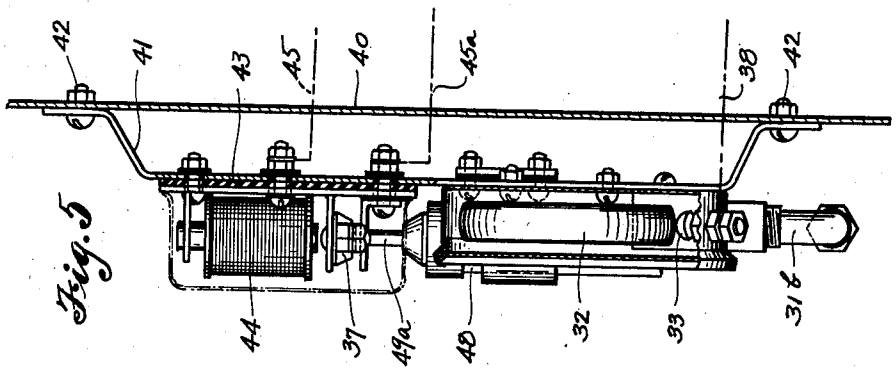


Fig. 5

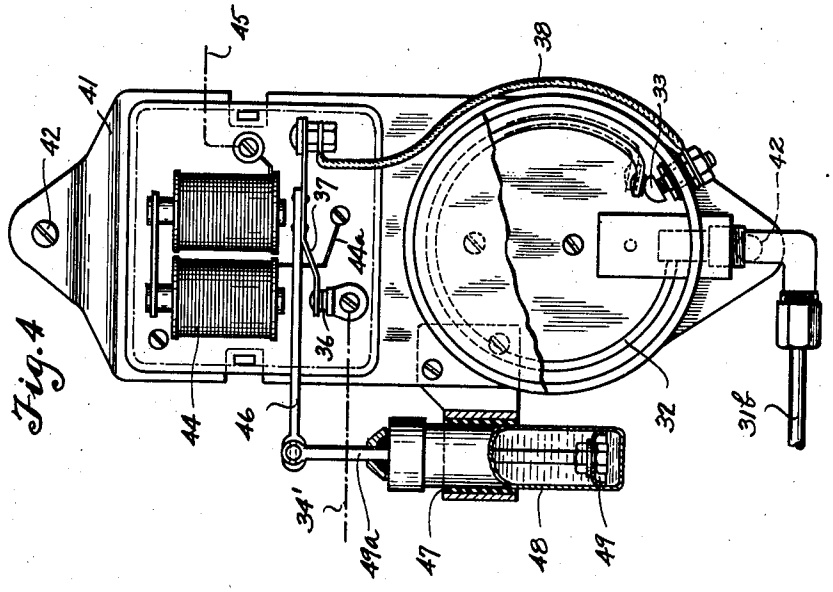


Fig. 4

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2,122,049

SAFETY DEVICE

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Application April 18, 1936, Serial No. 75,151

8 Claims. (Cl. 123—196)

This invention relates to safety devices for internal combustion engines of that kind employing electrical ignition and a forced feed oiling system; and, more particularly, it relates to a type of safety device that operates in conjunction with the ignition system of the engine under the control of the high pressure, forced feed oiling system.

It is the principal object of this invention to provide a safety device of the character above stated whereby the ignition circuit of the engine will be rendered ineffective to stop the engine should the oil pressure, for any reason, fall below a predetermined minimum for safe operation.

It is also an object of this invention to provide safety means of the above character, including a time delay element which will permit the usual starting of the engine regardless of its oil condition, and provides that the safety means does not become active until the engine has started under its own power and there has been opportunity for an oil pressure condition to be created.

It is another object of the present invention to provide for a manual, temporary disconnection of the safety device to permit operation of the engine regardless of its oil condition when such operation is desired.

More specifically stated, the present invention resides in the provision of a safety device for use in connection with various conventional types of automobile engines, to be operated under control of the oil pressure in the engine's oiling system, and including, as a part thereof, a shunt circuit that will automatically be closed in the event of lack or failure of oil pressure, thereby to shunt the ignition circuit from the spark plugs of the engine to thereby render the engine inoperative.

Other objects of the invention reside in the details of construction of the various parts, in their combination and in their mode of operation, as will hereinafter be fully described.

In accomplishing these, and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein:—

Fig. 1 is a view that diagrammatically illustrates the safety device as used in combination with the ignition and starting system of the usual type of automobile engine.

Fig. 2 is a side view of the auxiliary switch device employed in the safety system.

Fig. 3 is a sectional view of the auxiliary switch as seen on the line 3—3 in Fig. 2.

Fig. 4 is a front elevation of the control unit of the safety system as connected with the oil pressure line; a part of the housing of the unit and a part of the cylinder of the time delay element being broken away for better illustration.

Fig. 5 is a side view, and partial section of the control unit as seen in Fig. 4.

Referring more in detail to the drawings—

In order to better explain the character and mode of operation of the present safety system, I have, in Fig. 1, diagrammatically illustrated it as operatively connected with the oiling ignition and starting systems of a conventional type of automobile engine. In this view, 1 designates the usual current generator which in use is operatively connected with the engine so that, in the normal operation of the engine, it generates the necessary electrical energy for energizing the ignition system and also for supplying electrical energy to charge the storage battery which is designated by reference character 2. The negative pole of the generator 1 is grounded through the frame structure of the motor or vehicle by means of a circuit connection 3'. The positive pole of the generator is connected by means of a circuit wire 3, or the like, with an ammeter designated at 4, and a wire 5 connects the ammeter with the positive side of a starting switch designated at 6. The positive side of the battery 2 is connected to the starting switch by wire 7 and the negative side of the battery is grounded to the vehicle frame by means of a connection 10. The starting motor for the engine is designated at 9 and this is connected at its positive side with the negative side of the starting switch 6 by a circuit connection 8, and at its negative side it is grounded through the mediacy of a connection indicated at 11. The above arrangement provides that upon closing the starting switch 6, a circuit is closed through the starting motor which draws upon the reserve of electrical energy stored in the battery 2 and the starting motor, being operatively connected with the engine, sets the latter in motion. Operation of the engine at a predetermined speed, in turn, drives the generator 1, which creates electrical energy for energizing the ignition system, as is well understood in this art.

The ignition system also includes a starting switch 12 which is connected by a wire 13 with the ammeter 4 and by wire 15 with a circuit breaker point 14. There is also the usual circuit breaker arm 16, which, in its normal operation of oscil-

lating, causes engagement of a contact 17 on the arm with the contact 14, thereby to close the circuit to a condenser 18, which has electrical connection through the arm with the point 17. The negative side of the condenser is grounded by a connection indicated at 19.

The function of the condenser is well understood by those familiar with the art and will not here be discussed.

In the normal operation, the oscillation of the circuit breaker arm 16 causes a contact point 20 thereon to engage in circuit closing relation with a contact 21, which, in turn, is connected with the primary winding 22*a* of an inductance coil 22 having its negative pole grounded as indicated at 23. The secondary winding 22*b* of the inductance coil is grounded at one side, as at 24, and has its other side connected by wire 25 with the central pole 26 of a distributor 27, which, through connection 28, supplies electrical energy to the various spark plugs, indicated at 29, of the motor in proper timing. The connections between the distributor and spark plugs are indicated at 29, and the spark plugs are grounded in the usual manner, as indicated at 30.

It is apparent that, should the ignition circuit be grounded before reaching the induction coil 22, this would interrupt the energization of the spark plugs and, as a result, the engine would cease to operate. Therefore, it will here be explained that the present safety device contemplates a means whereby such grounding of the circuit to the induction coil will be effected incident to lack of a predetermined oil pressure occurring during the normal operation of the engine.

By reference to Fig. 1, which diagrammatically illustrates the arrangement of parts, 31 designates a conduit or pipe connection with the oil pressure line which is connected at any suitable point with the oiling system, and also which may be a connection that leads to an oil pressure indicator, as designated at 31*a*. Normally such an indicator is disposed upon the instrument board of the automobile in which the engine is installed. A branch pipe 31*b* leads from the line 31 and connects with one end of a Bourdon tube 32. When the engine is in operation, and the supply of oil is satisfactory, or in excess of a minimum necessary for safe operation, the pressure of oil will cause a slight movement of the tube toward straightening out, thereby to lift its free end away from a contact point designated at 33, to break a shunting circuit, presently to be described.

In its intended operation, the Bourdon tube serves as an automatic switch for automatically closing a shunt circuit which renders the induction coil ineffective and thereby interrupts the flow of electrical energy to the spark plugs. With the motor standing idle and no pressure in the oiling system, the Bourdon tube will be engaged with the contact 33.

The shunt circuit which the safety device employs in the present instance comprises a circuit wire 34 which leads from the arm 16 to one side of an auxiliary switch 35 and a wire 34′ which leads from the other side of the switch 35 to a contact member 36 employed in the control unit, being a principal part of the device, and which is disclosed particularly in Figs. 4 and 5. A yieldable switch arm 37 is arranged to electrically connect the point 36 with a circuit wire 38, which leads to the contact 33. It will be understood also that the Bourdon tube and its connection 31*b* are of circuit carrying material and are grounded, as indicated at 39. Thus, it is apparent that, with the switch arm 37 closed against contact 36, and with the auxiliary switch closed and with no oil pressure in the Bourdon tube, the ignition circuit, normally connected to the induction coil 22, will be grounded through the arm 16, and connections 34, 35, 34′, 36, 37, 38, 33, 32, 31*b* and 39. So long as either the switch 35 or 37 is open, or the Bourdon tube contacting the point 33, the shunt circuit will be open.

The safety unit employed in the present system has for its purpose to control this shunt circuit, and it will now be described: Referring particularly to Figs. 4 and 5, this illustrates the control unit which, as a matter of convenience, might be mounted upon the dash board 40 of the vehicle. A bracket member 41 serves as the mounting member for the unit and this bracket is indicated as being attached to the dash board by the bolts 42 at its upper and lower ends. Mounted on the upper end portion of the bracket, and insulated therefrom by means of the spacer 43, is an electro-magnet, designated in its entirely by reference numeral 44. A circuit connection 45 leads from the negative side of the starting switch 6 to one pole of the electro-magnet. The other pole of the magnet is grounded by a connection indicated at 44*a*. The armature 46 of the electro-magnet is fixedly connected to the yieldable switch arm 37 and also has connection with a time delay element designated at 47.

The time delay element, as best illustrated in Fig. 4, comprises a cylinder 48 containing a piston 49 which is connected by rod 49*a* with the outer end of armature 46. The cylinder contains a hydraulic medium and the piston is of a valve type of construction which permits it to be readily lifted and slowly returned under action of spring arm 37, to normal position by leaking of the hydraulic medium from the lower to the upper side of the piston.

With the connections as so far described, it is apparent that when a circuit is closed through the electro-magnet 44, the armature 46 will be lifted, thereby to break the electrical connection between the arm 37 and the contact 36, and this connection will remain broken until the time delay element has permitted the return of the arm 37 to its normal position, as indicated in Fig. 4. It will be explained here that in the present instance, a time delay interval of 30 seconds has proven to be quite satisfactory.

For a purpose presently apparent, I have included the auxiliary switch 35 in the grounding connection between the point 36 and the arm 16. This switch is actuated by means of a manually moved lever 50 connected to a shaft 51 rotatably mounted in friction bearings 52 and 53, which are formed as a part of a supporting bracket 54. This bracket may be attached to the dash board adjacent the control element. Also, fixed on the shaft 51, is a pivotally suspended weight 59 adapted normally to form a circuit connection between contacts 60 and 61 with which the wires 34 and 34′, respectively, connect.

By rotation of the shaft 51 through the mediacy of lever 50, the weight 59 will be lifted to the dotted line position in Fig. 3. It is intended, however, that the weight will swing down of its own accord upon the movement of the automobile over an uneven road surface, thus limiting the time or movement of the automobile while the motor is operating without proper oil in its lubricating system.

Assuming that the device is constructed in the

manner described, and that it is operatively connected in the system, as illustrated, its operation would be as follows:

With the auxiliary switch closed, and the switch arm **37** engaged with the contact **36** and the engine at rest, the Bourdon tube will normally engage with the contact **33**. Upon closing the starting switch **6**, current will flow through the starting motor **9** to start the engine. Coincident with the closing of the starting switch, the circuit will be closed through the electro-magnet **44**, which will lift the armature **46** upwardly, thereby disconnecting the circuit between the switch arm **37** and point **36**. Assuming that there is a satisfactory oil condition in the engine, the Bourdon tube will be expanded and thereby disengaged from the circuit contact **33**. As soon as the starting switch **6** is opened, the circuit to the electro-magnet is opened and the time delay element **47** starts functioning. Thus, after a predetermined time interval, the arm **37** again engages the contact **36**. Assuming that the oil condition is unsatisfactory in the engine, the Bordon tube will then complete the grounding connection and the supply of electrical energy to the spark plugs will be shunted through this connection to the ground **39**. In the event that the oil pressure is satisfactory, the grounding circuit will remain open, and this will be the case so long as there is enough oil or enough pressure in the system to expand the Bourdon tube end disconnected from the point **33**. In the event that the oil supply should fail while the vehicle was at some distance from a source of oil supply, the operator, naturally, would desire to continue on to the source of oil supply. Therefore, to open this grounding circuit and permit a continued operation of the engine in a normal manner, the auxiliary switch **35** would be opened.

It will be here mentioned that the auxiliary switch is only held in open position frictionally and that the normal vibration of the vehicle will eventually cause the weight **59** to drop into circuit closing contact with the parts **60** and **61**; the object of this being to prevent injury to the engine should the operator inadvertently overlook the closing of this switch.

It is apparent with the present safety device it would be impossible for the vehicle to operate under an unsatisfactory oil condition as provided for through the mediacy of the time delay element **47** and the auxiliary switch.

The minimum pressure at which the device may be set to function may be controlled by the setting of the contact **33**, which, as illustrated in Fig. 4, comprises a set screw that is inwardly and outwardly adjustable relative to the movable end of the Bourdon tube.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination with an engine of the character described, having an ignition circuit and having an oiling system maintained under pressure by the operation of the engine; of a safety device including a shunt circuit for diverting the ignition circuit from the engine, and a switch controlling the diverting circuit and adapted to be retained open by pressure of oil in the oiling system and permitted to close when the oil pressure is below a predetermined amount, and a time delay switch in the shunt circuit that will be opened incident to starting of the engine and closed after a predetermined interval.

2. The combination with an engine of the character described, having an ignition circuit and having an oiling system in which the oil is placed under pressure by operation of the engine; of a safety device including a circuit for grounding the ignition circuit to render the engine inoperative and a switch in the grounding circuit operable under control of pressure of oil in the oiling system, to close the grounding circuit when the pressure falls below a predetermined amount; said grounding circuit including also a time delay switch adapted to be opened incident to starting the engine and to close after a predetermined time interval.

3. The combination with an engine of the character described, having a starting circuit, an ignition circuit and a pressure oiling system operated by the engine; of a safety device including a circuit for grounding the ignition circuit to render the engine inoperative and a control switch and time delay switch in the grounding circuit; said control switch being operatively connected with the oiling system and operable to open or close the grounding circuit under the influence of oil pressure in the system and said time delay switch being opened incident to closing of the starting circuit.

4. The combination with an engine of the character described, having an ignition circuit and a pressure oiling system, of a safety device including a circuit for diverting the ignition circuit to render the engine inoperative, a switch in the latter circuit, operable under control of pressure of oil in the oiling system, to close the circuit when the oil pressure falls below a predetermined minimum, a normally closed time delay switch in the diverting circuit, and an electro-magnet with means whereby it is caused to be energized incident to starting the engine, for opening the time delay switch.

5. The combination with an engine of the character described, having a starting circuit under control of a starting switch, a pressure oiling system and an ignition circuit, of a safety device including a circuit for grounding the ignition circuit to render the engine inoperative, an automatic switch in the circuit operable by pressure in the oiling system, to close the circuit when the oil pressure is below a predetermined minimum, a time delay switch in the circuit, an electro-magnet having an energizing circuit adapted to be closed incident to closing the starting switch to open the time delay switch and maintain the grounding circuit open for a predetermined time interval.

6. A system as in claim 5 including a normally closed auxiliary switch in the grounding circuit and means for manually opening the auxiliary switch.

7. A system as in claim 5 including a normally closed auxiliary switch in the grounding circuit, and means whereby said switch may be manually opened; said auxiliary switch including a weighted switch arm arranged to close by gravity, manual means for moving it to open position having friction bearings for yieldingly retaining the arm in open position.

8. The combination with an internal combustion engine having a starting circuit including a normally open switch, an ignition circuit, and a pressure oiling system, of a safety device comprising a circuit for grounding the ignition circuit, a switch in said circuit movable under control of the pressure of oil in said oiling system

to closed position when the pressure is below a predetermined amount, a normally closed time delay switch in said grounding circuit, an electrically energized means for actuating the time delay switch to open position; said latter means having a circuit therefor connected with the starting circuit in a manner to be energized only during energization of the starting circuit, to open the last named switch for a predetermined interval following the starting of the engine, and an auxiliary switch in the ignition grounding circuit adapted to be manually opened.

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