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MOISTURE-ACTUATED ELECTRICAL SYSTEM FOR RAISING CONVERTIBLE AUTO TOPS

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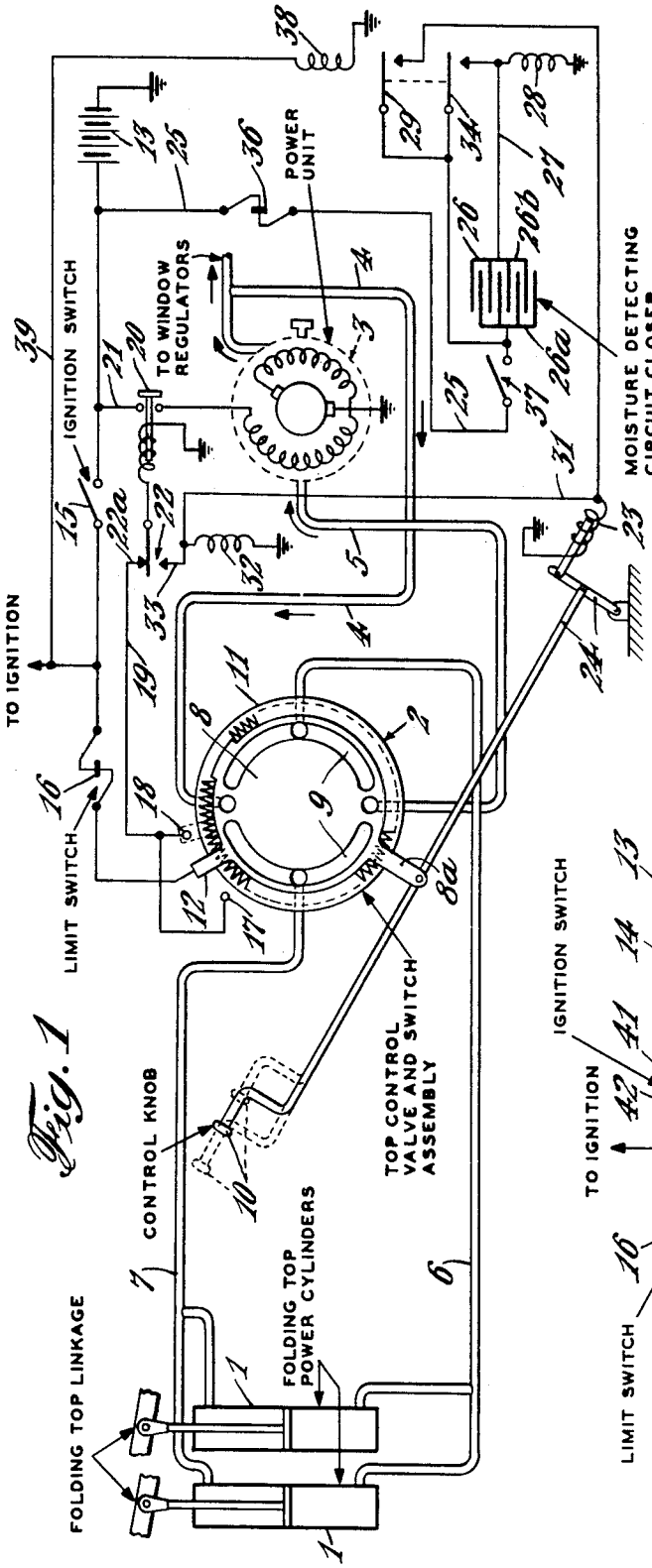

Fig. 1

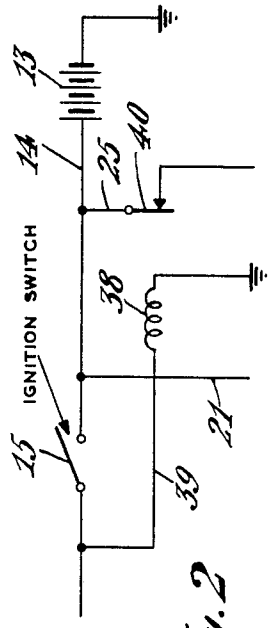

Fig. 2

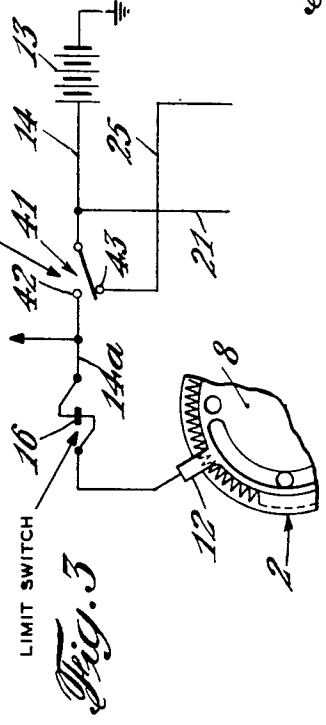

Fig. 3

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MOISTURE-ACTUATED ELECTRICAL SYSTEM FOR RAISING CONVERTIBLE AUTO TOPS

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1 Claim. (Cl. 318—483)

The present invention relates to a system for raising the top of a convertible auto, and more particularly to such a system which will be actuated by a moisture sensitive circuit closer so as to ensure raising of the top in the event of rain.

For some time, a number of the auto manufacturers have been installing power-operated devices of the electrical or hydraulic type for raising the tops of convertible autos and the windows of autos in general. However, without exception, these devices are under purely manual control and if the operator is not in the vehicle when rain commences to fall and the top has been left down or the windows open, serious damage will often occur to the interior appointments of the car. I have developed an electrical system which may be readily installed as an adjunct to the factory installations described, which will render their operation automatic immediately upon the falling of water on the car.

Accordingly, it is the primary object of the present invention to provide an electrical system which will prevent water damage to the interior of automobiles which have been left exposed to the elements.

Another object of the invention is to provide an electrical system for automatically raising the top of a convertible vehicle in the event of rain, which may be readily added to power-operated top raising and lowering systems installed at the factory or with but slight structure modification be made a part of the original factory installation.

Still another object of the invention is to provide an electrically operated system for automatically raising the top of a convertible auto upon commencement of rain which will be disabled unless the ignition switch of the auto is in open position.

Yet another object of the present invention is to provide an electrical system for automatically raising the top of a convertible auto when it rains which will be in operation and drawing current only for a period closely corresponding to the time required for raising the top.

Another and further object of the invention is to provide an electrical system for automatically raising the tops of convertible autos when it rains which will be sure and safe in operation yet may be economically assembled and installed.

Other and further objects of the invention will be apparent from the following detailed description taken in conjunction with the drawings, in which:

Fig. 1 is a schematic showing of the circuits embodied in a preferred form of the invention; and

Figs. 2 and 3 show alternative modifications for insuring disabling of the system if the ignition switch is on.

Referring to the drawings, it may be stated that the invention has been illustrated as an addition to a factory installed conventional hydraulic system for raising convertible tops. It will be understood, of course, that if the system of the present invention is installed at the factory as standard equipment, there may well be minor differences from the combined circuits illustrated. In adapting the present moisture actuated top raising system to the

conventional top raising and lowering system illustrated, it has been necessary to make only one small change in the basic circuit as will be pointed out hereinafter.

The manufacturer's top raising installation includes a pair of hydraulic motors **1** arranged one at each side of the vehicle and suitably connected to the operating linkage of the convertible top, a valve member, generally designated by the numeral **2**, and a hydraulic power unit **3**. The power unit **3** comprises an electric motor driven pump which has an outlet conduit **4** and an inlet conduit **5** in communication with valve **2**.

A pair of branched conduits **6** and **7** afford communication between the valve **2** and motors **1** on opposite sides of the pistons.

The valve **2** may include a rotatable disc **8** provided with a pair of opposed elongated slots **9** so that if the disc is rotated in either direction from the neutral position shown in Fig. 1, hydraulic liquid is admitted to one end of the motors and exhausted from the other. Thus it is seen that depression of the control knob **10**, which is suitably connected to an arm **8***a* secured to valve disc **8**, will establish communication between the outlet **4** or pressure side of power unit **3** and conduit **6** admitting hydraulic liquid to the lower ends of motors **1** and at the same time between inlet **5** and conduit **7** so as to exhaust liquid from the upper ends of the motors **1**. This will cause the convertible top to raise, and in the same manner, pulling out of the control knob **10** will cause the top to be lowered. Spring means, such as coil spring **11**, is employed to return the knob **10** and valve disc **8** to a neutral position.

In order to start the electric motor of power unit **3** at the proper time to supply hydraulic liquid for raising or lowering the top, a two-way switch is combined with the valve **2**. A contact **12** is secured to the valve disc **8** to turn therewith and current is supplied to contact **12** from the car battery **13** by means of a conductor **14**. It will be noted that the ignition switch **15** of the vehicle is in series with conductor **14** so that the ignition switch must be closed before the top can be raised or lowered, thus preventing unauthorized tampering with the mechanism.

A circuit breaker **16** is also interposed in conductor **14** to insure stopping of the electric motor after raising or lowering of the top even if the control knob **10** is maintained in depressed or extended position. The circuit breaker **16** may be of any conventional design such as a limit switch actuated by the top in fully up and fully down position, or a time controlled switch.

If the control knob **10** is depressed, the contact **12** will meet a contact **17** and if the control knob is pulled out it will meet a contact **18**. A branched conductor **19** supplies current to a solenoid actuated relay **20** having normally open contacts upon the closing of the circuit to either contact **17** or **18**. The actuation of relay **20** immediately furnishes current to the electric motor of power unit **3** through a conductor **21** leading from conductor **14** so that hydraulic liquid is immediately furnished to raise or lower the top.

As stated, the system described to this point is conventional and often installed by the car manufacturers. The only change in this basic circuit which is necessary for the incorporation of the present automatic top raising system is the placing of normally closed contacts **22***a* of relay **22** in the conductor **19**. The reason for this change in the basic circuit will be explained hereinafter.

The present moisture sensitive top raising system may be installed in connection with the basic top raising and lowering circuit just described. To accomplish this, an electrical system has been added to the basic circuit, which upon the collection of moisture upon a moisture detecting circuit closer, will produce rotation of the valve disc **8** in the same manner that it is rotated by depressing the

control knob 10. This may be directly accomplished by a solenoid 23 acting through suitable linkage 24 connected to the same arm 8a to which the control knob 10 is connected. The electrical system for actuating solenoid 23 and providing electric current for starting the pump motor will now be described.

It will be recalled that in the conventional manual top raising and lowering system described above, operation was impossible unless the ignition switch was closed. In the present automatic moisture-actuated top raising system, however, not only must actuation take place when the car is parked with the ignition switch off, but means, which will be described later, must be employed to prevent automatic operation of the system when the ignition switch is on. Otherwise the system might be actuated when the vehicle is traveling at a high rate of speed and damage the top.

Therefore, in the first place, the conductor 25 is connected to the conductor 14 between the battery 13 and ignition switch 15. The line 25 leads to one terminal 26a of a moisture detecting circuit closer 26 which may comprise a pair of comb-like interdigitated members. A preferred form of detecting circuit closer is that described in my prior application, Serial No. 285,810, filed May 2, 1952, for Moisture Actuated Circuit Closer, but other types of moisture actuated circuit closers may be employed, if desired. As described in my said prior application, the circuit closer comprises a base of insulating material and a pair of conductors secured to the base in separated but closely adjacent position so that the conductors may be bridged by drops of a conducting liquid impinging thereon.

Since the circuit closer 26 cannot carry the current loads necessary to operate the electrical system, the other terminal 26b of the circuit closer 26 is connected by a conductor 27 to a sensitive relay actuating coil 28. When current is supplied to coil 28 upon collection of moisture on circuit closer 26, normally open relay contacts 29 are closed to close a circuit from the battery through the conductor 25 and conductors 30 and 30a to the solenoid 23, thus supplying current directly from battery 13 to rotate valve disc 8.

Since with the ignition switch open, the junction of contact 12 with contact 17 will not supply current for the actuation of relay 20 to start the electric pump motor, a conductor 31 is connected with the conductor 30a and leads to the actuating coil 32 of relay 22, which when energized will open the normally closed contacts 21a of relay 22 and close the normally open contacts 33 to connect conductor 31 to the coil of relay 20. This closes the normally open contacts of relay 20 to cause current to be supplied to the electric motor of power unit 3. The reason that relay 22 cannot be omitted and line 31 connected directly to line 19 is that, if this were the case, actuation of the automatic top raising system would close the vehicle ignition system and supply current to any other electrical device conditioned for operation which is connected to the conductor 14 beyond the ignition switch.

Separate coils 32 and 23 have been shown in the schematic drawing Fig. 1 to actuate the contacts of relay 22 and to rotate the disc 8 of the valve 2, but it is to be understood that a single coil could be employed for this purpose.

In order to continue the raising of the top if the flow of current through circuit closer 26 should be broken before the top is fully up, normally open contacts 34 are provided in parallel with the circuit closer 26. The contacts are closed when coil 28 is energized so that operation of the top raising system initiated by the moisture sensitive circuit closer 26 will continue until the circuit is opened by operation of a circuit breaker 36 positioned in conductor 25, which circuit breaker may be similar to and actuated in the same manner as circuit breaker 16 of the conventional top raising and lowering system.

There may also be placed in conductor 25 a manually operated switch 37, which will completely disable the present moisture sensitive top raising circuit or condition it for operation, as desired.

Earlier, it was pointed out that it was imperative that the automatic, moisture sensitive top raising system be incapable of actuation when the ignition switch is on. In Fig. 1 is shown one means for insuring this result in a positive manner. A coil 38 is connected by conductor 39 to the conductor 14 at a point beyond ignition switch 15 so that it will be energized at all times when the ignition switch is closed. The coil 38 is positioned so that energization of this coil will bias the relay contacts 29 and 34 to open position with sufficient force so that contacts 29 and 34 will remain open if coil 28 is subsequently energized.

Another way to prevent operation of the moisture sensitive top raising system when the ignition switch is closed is shown diagrammatically in Fig. 2. In accordance with this modification, a separate relay 40 having normally closed contacts in conductor 25 is opened by energization of coil 38 upon closing of ignition switch 15. Here again the automatic system cannot be operated when the vehicle ignition system is energized.

Still another means for accomplishing the same result is shown diagrammatically in Fig. 3. This means would probably be employed only if the moisture sensitive system were installed on the vehicle as original equipment, since it would require material alteration of the conventional ignition switch.

In this modification, a two-way switch 41 is substituted for the usual ignition switch. From one contact 42 of switch 41, a conductor 14a leads to the ignition system and to contact member 12, and to the other contact 43 the conductor 25 is connected. No additional relay actuating coil such as the coil 38 would be required in this form of the invention, but otherwise the construction and operation of the system is the same as in the forms illustrated by Figs. 1 and 2.

By the foregoing there has been described an electrical system of relatively simple and economical construction for automatically raising the tops of convertible autos when it commences to rain and the vehicle is parked with the ignition key in "off" position. Positive means has been described for preventing operation of the system when the vehicle is in motion, making use of the fact that at this time the ignition key is normally in its "on" position. The system has been diagrammatically shown and described in connection with a hydraulic system but it is to be understood that it is equally adaptable for use with a top raising and lowering device in which an electric motor is directly used as the source of power.

Also it will be noted that in Fig. 1 a branch conduit is shown leading from the pump of power unit 1 to window regulators of the vehicle. It is to be understood that the present moisture sensitive top raising system may be readily modified to raise the windows of a convertible auto simultaneously with the top or the windows alone of vehicles other than convertibles, which are equipped with power means for raising and lowering the windows.

Having described my invention, I claim:

An electrical system for raising the top of a convertible auto when rain falls, said auto having an ignition switch, comprising a source of electric current; power means for raising said top including an electric motor; a first electrical circuit connecting said electric motor with said source of electric current; a relay having normally open contacts in said first electrical circuit to prevent flow of current to said motor, said relay in said first circuit having a coil acting to close said normally open contacts of said relay in said first circuit; a second electrical circuit connecting said coil with said source of electric current; a relay having normally open contacts in said second elec-

trical circuit for preventing flow of current to said coil, said relay in said second circuit having a coil acting to close said normally open contacts of said relay in said second circuit; a third circuit connecting said last-mentioned coil with said source of electric current; a normally open circuit closer in said third electrical circuit, said circuit closer being closed by the collection of moisture thereon and comprising a base of insulating material and a pair of conductors secured to the base in separated but closely adjacent position so that the conductors may be bridged by drops of a conducting liquid impinging thereon; means responsive to closing of said circuit closer to prevent opening of said third electrical circuit upon

loss of the drops of conductive liquid bridging said conductors; a limit switch arranged to open said third circuit upon completed raising of said top; and means positively to prevent energization of said electric motor when said ignition switch is closed.

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