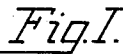
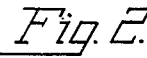


1,582,825

CONTROL SYSTEM

IGNITION



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UNITED STATES PATENT OFFICE.

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CONTROL SYSTEM.

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To all whom it may concern:

Be it known that I, LEROY D. KELLOGG, a citizen of the United States of America, and a resident of Deerfield, county of Lake, and State of Illinois, have invented certain new and useful Improvements in Control Systems, of which the following is a specification.

My invention relates to control systems in general and may be used with a combined water supply and storage battery charging control system for automatically maintaining the pressure of the water supply within certain limits, and for also maintaining the voltage of the storage batteries within certain predetermined limits; and an object of my invention is to provide a control system which is simple in construction and positive and most efficient in its operation.

Hydraulic or pneumatic water systems are used for supplying water in homes where there is no municipal water plant, and systems of this type usually comprise a pump which is motor-driven, a pressure tank and an automatic control which starts and stops the motor when the water pressure rises or falls beyond predetermined points. A lighting system may comprise a gas engine, directly connected to a dynamo, which, when the gas engine is running, generates current to charge storage batteries associated with the lighting system. An automatic control is provided which starts and stops the gas engine when the voltage of the storage batteries is below or above predetermined limits. My invention is applicable to systems of this type, and a feature of my invention is the provision of means whereby I combine the controls in a unitary system so that when the water pressure falls below its minimum predetermined limit, automatic means are provided for starting the pump into operation to again raise the pressure to its maximum. I provide means so that after the water pressure is raised, the batteries of the lighting system will automatically be charged if their voltage is at point where a charge is required.

Other features of my invention not specifically referred to above will appear in the detailed description and appended claims, and other advantages attained will be described in reference to the accompanying drawing of which Fig 1 is a diagrammatic showing of my system, whereas Fig. 2 is

a diagram of the circuit connections employed.

Referring now in general to my invention as illustrated in the accompanying drawing, and referring particularly to Fig. 1, I illustrate my system in a more or less diagrammatic way. I illustrate a combined starting motor and dynamo SD, directly connected to a gas engine GE, which is provided with electric starter means, and this portion of the drawing represents a typical residence lighting plant. A set of storage batteries are also associated with the light plant, connected as shown in Fig. 2.

As to the combined starting motor and dynamo SD, when the starting circuit is closed, the engine is turned over, and as soon as it picks up the starter motor winding, is automatically opened, and as the dynamo is connected to the shaft of the gas engine, the dynamo will deliver current to operate a motor or will deliver current to the storage batteries, should they be below their minimum predetermined charge, and when they are charged to a maximum, the engine is automatically shut off.

To the left of the lighting plant LP, I illustrate an air pump AP of any approved type, driven by a suitable motor M, which is operatively connected to the air pump through the medium of a suitable pinion 2 upon the shaft of the motor M and a gear wheel 3 secured to the shaft of the air pump AP. A supply tank ST for storing compressed air for use in the water system is provided, and a pipe line 4 connects the supply tank with the air pump AP. A suitable pressure gauge 5 is connected to the tank ST, as is also a safety valve 6. A check valve 7 is connected in the pipe line 4, which connects the supply tank ST with the air pump AP for the usual purposes.

An automatic pressure control AC is provided, which is connected with the supply tank ST through the medium of a pipe line 8, so that the pressure may be used to shift the control when the pressure falls or rises beyond predetermined points. The automatic pressure control AC may be of any approved type, and for the purpose of illustration I show a simple one, which comprises an air chamber cylinder 9 with a plunger 10 and a coil spring 11. When the pressure in the supply tank ST is at its maximum predetermined point, the piston or plunger 10 is

forced upward against the tension of the spring, and when the pressure falls to its minimum predetermined point, the spring forces the plunger down in the air chamber cylinder 9. The plunger has secured there-
 5 to a connecting link or rod 12, which is in turn connected to an automatic switch S of any approved type, one of which is more or less diagrammatically illustrated in the ac-
 10 companying drawing.

The water pressure system as herein illustrated is known as a pneumatic system, and a supply pipe 62 leads from the supply or pressure tank ST into a well or other source
 15 of water supply and is connected to an air motor actuated pump device operated by means of the compressed air that is supplied from the supply tank ST through the agency of the pipe line 62. The system may also
 20 be of the hydro-pneumatic type, in which the pump operated by the motor M would be a hydraulic pump which will pump the water into the tank, air also being supplied, and as will be evident, such a control as that
 25 indicated at AC would be suitable to such a system.

Referring to Fig. 2, I illustrate a circuit diagram to be associated with the control system for controlling the starting and stop-
 30 ping of the motor for driving the pump of the water system and for starting and stopping the gas engine whenever the voltage of the storage batteries is above a predetermined point.

35 Having described in general the apparatus embodying my invention, I will now describe in detail the operation of the combined water system and lighting system.

Assuming now that the apparatus is in the
 40 condition as illustrated in Figs. 1 and 2, and further assuming that the pressure range of the water system is fixed at fifty pounds for a maximum and thirty pounds for a minimum, and that the pressure in the water sys-
 45 tem has dropped down to its minimum point of thirty pounds, the spring 11 in the air chamber cylinder 9 of the automatic pressure control overcomes the pressure in the pipe line 8 and forces the piston 10 down, and due
 50 to the connecting link 12 connected to the arm 13 of the automatic switch S, causes the contact arms 14, 15 and 16 of the switch S to be rotated about their pivot, a suitable weight 17 fastened to the angular arm 13
 55 aiding the spring 11 as soon as said weight passes vertical, and said arm 13 engages the pin 133^a on the bifurcated switch member 133 and throws said member to the right until it encounters the stop 133^b, the arm 13 itself
 60 stopping when it engages stop 13^a. The contacts 14, 15, 16 will now be shifted to the left as they are carried on the member 133. The contact arm 15 is operatively associated with a contact 19, and during part of its
 65 movement the said arm 15 engages the con-

tact 19 to close an energizing circuit for the slow-acting primary ignition control relay PIC, said circuit traced from ground
 70 through the winding of the relay PIC, conductor 20, through the contact arm 15 of the switch S, the momentarily engaged contact 19, conductors 21 and 22 to the storage bat-
 75 tery SB and to ground. Closing of alternate contact 23 of the relay PIC closes an energizing circuit through the starting winding
 80 24 of the combined starting motor and dynamo SD, traced from ground through the starting winding 24 of the combined starting motor and dynamo SD, the closed contact
 85 25 associated with the dynamo SD, conductor 26, alternate contact 23 of the relay PIC, conductors 27 and 22, to the storage battery SB to ground. Due to the slow-to-release
 90 construction of the relay PIC, the said relay is held energized for a short time after the contact arm 15 of the switch S has passed beyond and disengaged the contact 19, and the alternate contact 23 of the relay PIC is
 95 thus held closed temporarily to maintain the circuit for the starting motor winding 24 of the combined starting motor and dynamo SD to permit the starting motor to turn over
 100 the engine GE a sufficient number of times to start it. The closing of alternate contact 28 of the relay PIC upon its energization closes the ignition circuit for the gas engine GE of
 105 the lighting system, over conductors 29, 30 and conductors 31, 32. From the above description, it may be seen that the circuit through the winding 24 of the starting motor
 110 and the ignition circuit of the gas engine are simultaneously closed, and as soon as the starting motor turns over the gas engine, it immediately picks up and runs on its own
 115 power. The dynamo SD is directly connected to the shaft of the gas engine GE, and the dynamo is also rotated and current is generated by said dynamo D, which current will
 120 flow from the dynamo D, over conductor 33, through the winding of the secondary ignition control relay SIC, over conductor 34, the contact arm 16 of the switch S, contact
 125 35, through the motor M associated with the air pump AP to ground. As soon as the gas engine picks up and the dynamo is generating the contact 25 is opened by suitable
 130 means associated with the dynamo to cut out the starting winding 24. The motor M starts running, and the pump is operated to supply air through the pipe line 4 to the supply tank ST to raise the pressure of the said tank to its maximum predetermined point, which we have assumed is fifty pounds. The
 135 closing of alternate contact 60 of the relay SIC closes a substitute ignition circuit for the gas engine GE as the initial ignition circuit is open at alternate contact 28 of the relay PIC upon its de-energization. When
 140 the pressure reaches this point, the pressure of the air in the pipe line 8 which is connect-

ed with the automatic pressure control AC overcomes the tension of the spring 11 and forces the plunger 10 upward, and due to the connecting link 12 which is secured to the arm 13 of the switch S, the said arm is moved upward, and this movement causes the arms 14, 15 and 16 to be rotated by the aid of weight 17, but in a reverse direction, about their pivot to disengage and engage contacts to bring about circuit changes, as will be presently described. The contact arm 16 in its return movement disengages the contact 35, which opens the circuit of the motor M, and the motor now stops. I also provide a sensitive current control CC of any approved type, which is operatively associated with the storage batteries SB, and as long as the storage battery SB stays within its maximum and minimum limits, the pointer 37 of the current control CC remains in its intermediate position. A winding 36 associated with the current control CC is connected in circuit with the storage battery, the circuit through the winding 36 being traced from the negative pole of the battery SB, over conductor 38, through the winding 36 of the current control CC, over conductor 39 to the positive pole of the storage battery SB.

Assuming now that the storage battery SB has dropped below its minimum voltage point, the pointer 37 of the current control will have moved to the left, which is the low voltage side LV of the current control CC, into engagement with the contact 40, closing an energizing circuit for the differential relay DR, which may be traced from the storage battery SB, over conductors 42 and 43, through the upper winding 44 of the differential relay DR, conductor 45, through the contact 40 and pointer 37 of the current control CC, to ground over conductor 39. The relay DR is energized over this circuit, and the closure of its alternate contact 46 establishes a locking circuit for itself traced from battery SB, over conductors 42 and 43, through the upper winding 44 to ground at alternate contact 46. The secondary ignition control relay SIC, due to its slow release construction, is momentarily held energized after its circuit is opened by the disengagement of the contact arm 16 from its contact 35, and until a substitute circuit is established for it, should the voltage of the storage battery be below its minimum predetermined limit, which may be traced from the dynamo D, over conductor 33, through the winding of the relay SIC, its alternate contact 47, conductor 48, contact arm 14 of the switch S, contact 49, conductor 50, alternate contact 51 of the relay DR, conductors 52 and 22 through the storage battery to ground an alternate circuit to ground being through the winding 44 and armature 46 of the relay DR.

The current generated by the dynamo D is now delivered to the storage battery SB, and when the latter is charged to its maximum predetermined point, the circuit through the winding 36 of the current control CC causes its pointer or arm 37 to move to the right which is the high voltage side HV of the current control CC, to engage the contact 41, and the engagement of the pointer 37 with the contact 41 establishes a circuit through the lower winding 53 of the relay DR, this circuit being traced from the storage battery SB, conductors 42 and 43, through the lower winding 53 of the relay DR, its alternate contact 54, conductor 55, contact 41, pointer 37, to ground over conductor 39. Current now flows through both windings 44 and 53 of the relay DR, and due to its differential construction the relay de-energizes, and the opening of its alternate contact 51 opens the circuit from the dynamo D to the storage battery SB, and the secondary ignition control relay SIC is de-energized, and the opening of its alternate contact 60 opens the ignition circuit of the gas engine GE associated with the lighting system LP, and the gas engine now stops running. The apparatus of the combined control for the water and lighting system is now in its normal condition.

Should the voltage of the storage batteries SB of the lighting system drop below the minimum predetermined limit, and the pressure of the water system be within its predetermined limits, the pointer 37 of the sensitive current control CC will be engaging the contact 40, and for an emergency of this kind I provide a manually operated key K, which may be depressed to start the gas engine to turn over the dynamo to generate current for recharging the storage batteries. Now, when the key K is depressed, the closure of contacts 63 and 64 brings about the energization of the primary ignition control relay PIC, circuit being traced from ground through the winding of the relay PIC, conductors 20 and 65, and through the closed contacts 63 and 64, conductor 27, conductor 22, to the storage battery SB. The relay PIC upon energization closes its alternate contact 23 to close a circuit for the starting motor of the lighting system, from battery SB, over conductor 22, conductor 27, alternate contact 23 of the relay PIC, conductor 26, closed contact 25, through the winding 24 of the starting motor to ground. The starting motor now turns over the gas engine, and as alternate contact 28 is also closed on the energization of the relay PIC, the ignition circuit for the gas engine is closed, and the gas engine is started. The key K upon being depressed also closes contacts 66 and 67 to establish an energizing circuit for the secondary ignition control relay SIC, the

current for energizing this relay being traced from the dynamo D of the lighting system, over conductor 33, through the winding of the relay SIC, conductors 34 and 68, through closed contacts 66 and 67 of the key K, conductors 69 and 48, contact arm 14 of the switch S, its contact 49, conductor 50, alternate contact 51 of the relay DR, conductors 52 and 22, to ground through 44—46, an alternate circuit to ground being through the storage battery SB. The relay DR was energized when the pointer 37 of the current control CC engaged the contact 40 over circuit from battery through conductors 42 and 43, through the upper winding 44 of relay DR, conductor 45, to the contact 40 of the pointer 37 to ground, and DR now has closed its alternate contact 46 and established a locking circuit for itself over a circuit as previously described. Relay SIC on energization closes its alternate contact 47, and the generated current from the dynamo D now extends over a circuit which may be traced from the dynamo D, over conductor 33, through the winding of the relay SIC, its alternate contact 47, conductor 48, to ground over the previously described path. The key K was but momentarily depressed, and when released the contacts 63 and 64 are again opened to open the circuit of the relay PIC, and the contacts 66 and 67 are also opened, but the relay SIC is held in its energized condition over the substitute circuit established for it when its alternate contact 47 was closed. When the storage batteries SB are fully charged, the pointer 37 of the current control CC disengaged contact 40 and engages contact 41 to close a circuit through the lower winding 53 of the differential relay DR, and due to its differential construction, the said relay de-energizes, and the opening of its alternate contact 51 opens the circuit of the relay SIC, and the opening of alternate contact 60 of the relay SIC opens the ignition circuit of the gas engine of the lighting system, and the gas engine now stops and no further current is generated.

From the above description it may be seen that I have provided an automatic control system for a combined water and lighting system, and I have also provided manual means for starting the gas engine of the lighting plant to generate current to recharge the storage batteries, should the voltage drop to its minimum predetermined limit.

By means of the passing contact 15—19 and the relay PIC, which latter takes a definite time to release, I provide a positive starting time for the gas engine and one entirely adequate if the engine is in condition to be started. If, for lack of fuel or other reason, the engine will not start, it will be noted that the storage battery is cut off

from the starting circuit as soon as PIC de-energizes, so that under no circumstances will the battery run itself down by turning over indefinitely an unstartable engine. Obviously, the key K will be used by the attendant to start the system in case contact 15—19 fails to do so.

While I have described my invention operating in connection with one form of water system and lighting system, I do not wish to be limited to the exact structure as shown, as my invention is applicable to other systems, and changes and modifications will also suggest themselves to those skilled in the art, and I, therefore, wish to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is:

1. A control system of the character described comprising a combined water supply and storage battery lighting system, an automatic pressure control for maintaining the pressure of said water system within certain limits, an automatic sensitive circuit closer for maintaining the charge of said storage battery within certain limits, a dynamo for charging said battery and a motor for said water system driven by current directly from said dynamo and means for preventing the charging of the storage battery and increasing the pressure of said water system at the same time.

2. A control system of the character described comprising a combined water supply and storage battery lighting system, an automatic pressure control for said water system for maintaining the pressure of said water system within certain limits, a switch controlled by said pressure control, an electric motor driven pump for said water system, actuating means for said switch under the control of said pressure control for automatically starting said pump when the pressure of said water system falls below a certain limit, and means for testing the charge of said storage battery at the time that the circuit of the electric motor driven pump is opened and if the charge of the storage battery is below a certain point to charge said storage battery until the charge of the same has reached a predetermined point.

3. A control system of the character described comprising a combined water supply and storage battery lighting system, an automatic pressure control for said water supply system, an automatic sensitive circuit closer for said lighting system for maintaining the potential of said storage battery within certain limits, a switch for said system under the control of said automatic pressure control and adapted to be actuated when the pressure of the water system falls below a certain limit, an electric motor driven pump

for said water system, circuit connections established for said motor when said switch is actuated to start the operation of said pump, and means for preventing the charging of the storage battery while said pump is in operation.

4. A control system of the character described comprising a combined water supply and storage battery lighting system, a combined starting motor generator and engine for said lighting system, an electric motor-driven pump for said water system, a control switch for said system, a pair of slow-acting relays, an automatic pressure control operatively associated with said switch and adapted to actuate the same when the pressure of said water system falls below a certain limit to automatically energize said slow-acting relays to close circuit connections for operating said combined starting motor generator and engine, or operating said motor-driven pump, a differential relay, a sensitive circuit closer for said lighting system automatically moved in one direction when the voltage of said battery drops below a certain limit to actuate said differential relay to close a circuit for one of said slow acting relays to cause said gas engine to operate said generator to charge said storage battery of said lighting system.

5. A control system of the character described, comprising a combined water supply and storage battery lighting system, individual control means for said water supply and lighting system for maintaining the pressure of said water supply and the voltage of said storage battery within their maximum and minimum predetermined limits, a switch associated with said combined system actuated when the pressure of said water supply falls below its minimum fixed limit, a contact and a contact arm for said switch, an engine driven generator for said lighting system and an electric motor-driven pump for said water supply system, a slow release relay associated with said control system energized when the said contact arm engages said contact to close a circuit for means to start said engine of said light system to operate said generator.

6. A control system of the character described comprising a combined water supply and storage battery lighting system, an automatic pressure control for said water supply system and a sensitive circuit closer

for said lighting system for maintaining the pressure of said water supply and the voltage of said storage battery of said light system within their maximum and minimum predetermined limits, a switch operatively associated with said pressure control, a pair of relays associated with said control system, connecting means between said pressure control and said switch for actuating said switch when the pressure of said water system drops below its minimum fixed limit, a contact arm and a contact for said switch passively closed when said switch is actuated to close a momentary energizing circuit for one of said relays, an electric motor-driven pump for said water supply system and an engine-driven generator for said lighting system, starting means for said engine closed upon the energization of one of said relays to start said engine to actuate the generator to deliver current to said motor-driven pump, and a circuit for the second of said relays for maintaining the circuit of said engine and generator for the delivery of current to said battery should its voltage drop below its minimum fixed limit.

7. A control system including a dynamo, a motor and a storage battery, an engine for driving the dynamo, a pressure controlled device, automatic means controlled by said pressure controlled device for starting said engine while said motor is connected to said dynamo, means for automatically switching said dynamo from said motor to said battery, a differential relay, and a switch operatively associated with said relay and sensitive to the charge in said battery to automatically stop said engine.

8. A pressure system, an automatic pressure controlled switch for connecting a source of current to said system to increase the pressure, a storage battery charging system, said switch serving on increased pressure to connect said source with said last system, a differential relay and an automatic device operatively associated with said relay and sensitive to the charged condition of said battery to disconnect said source, said source of current being connected to only one of said systems at a time.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 7th day of November, 1921.

LEROY D. KELLOGG.