No. 708,195. Patented Sept. 2, 1902.

J. H. BICKFORD.

CONTROLLING DEVICE FOR ELECTRIC GENERATING SYSTEMS.

(Application filed Dec. 18, 1900.)

(No Model.)

4 Sheets—Sheet 1.

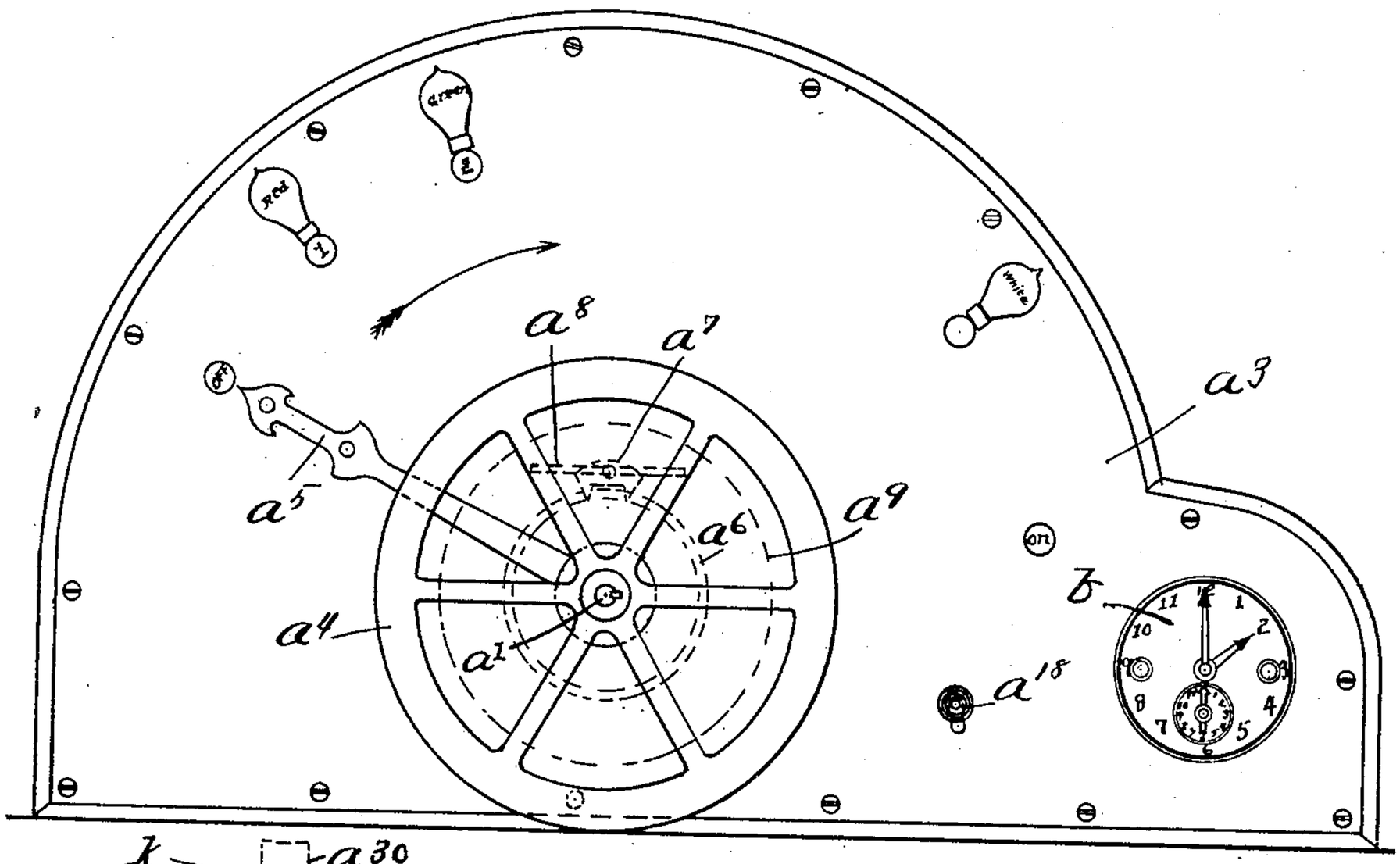

Fig. 1.

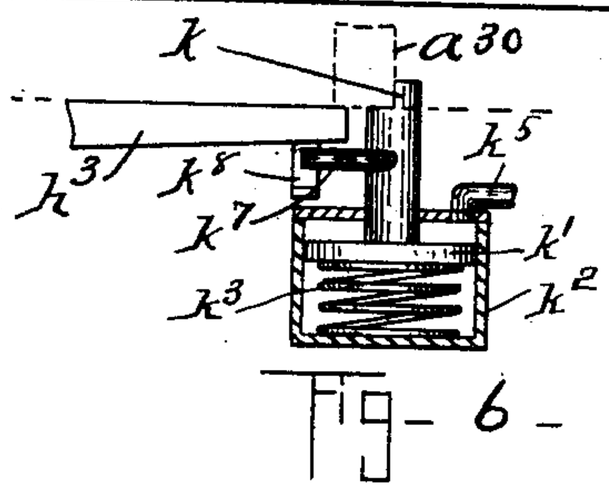

Fig. 6.

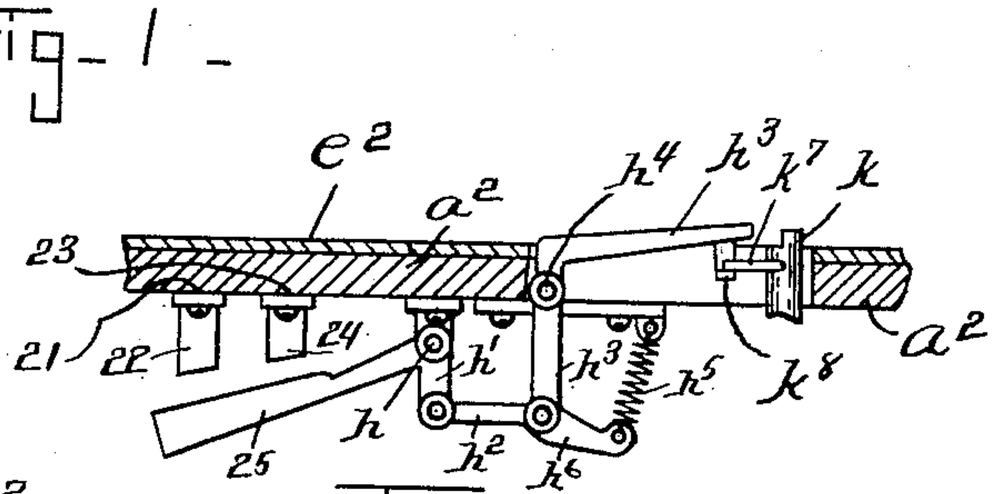

Fig. 4.

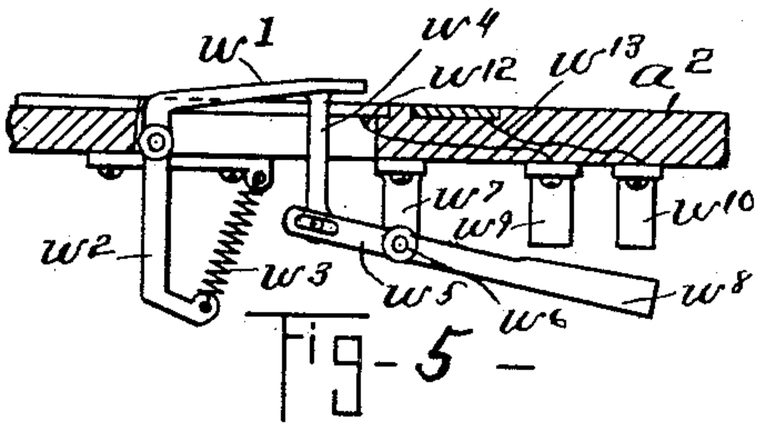

Fig. 5.

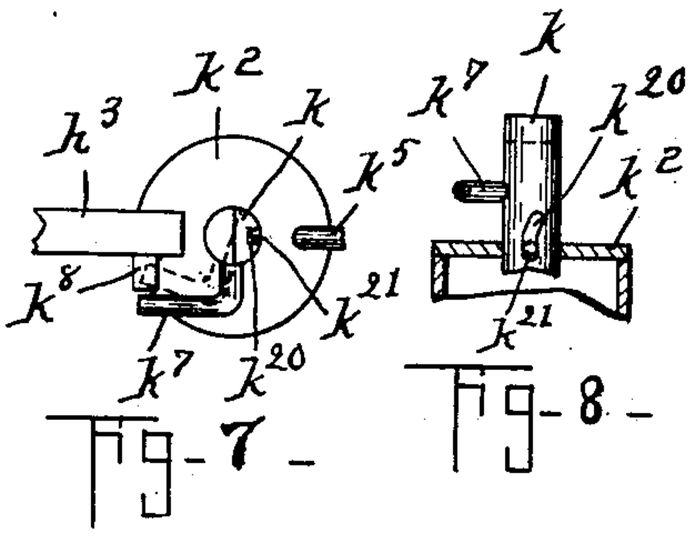

Fig. 7. Fig. 8.

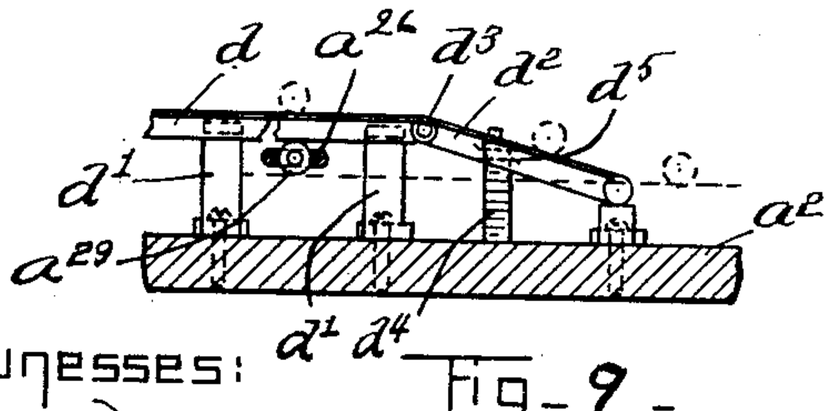

Fig. 9.

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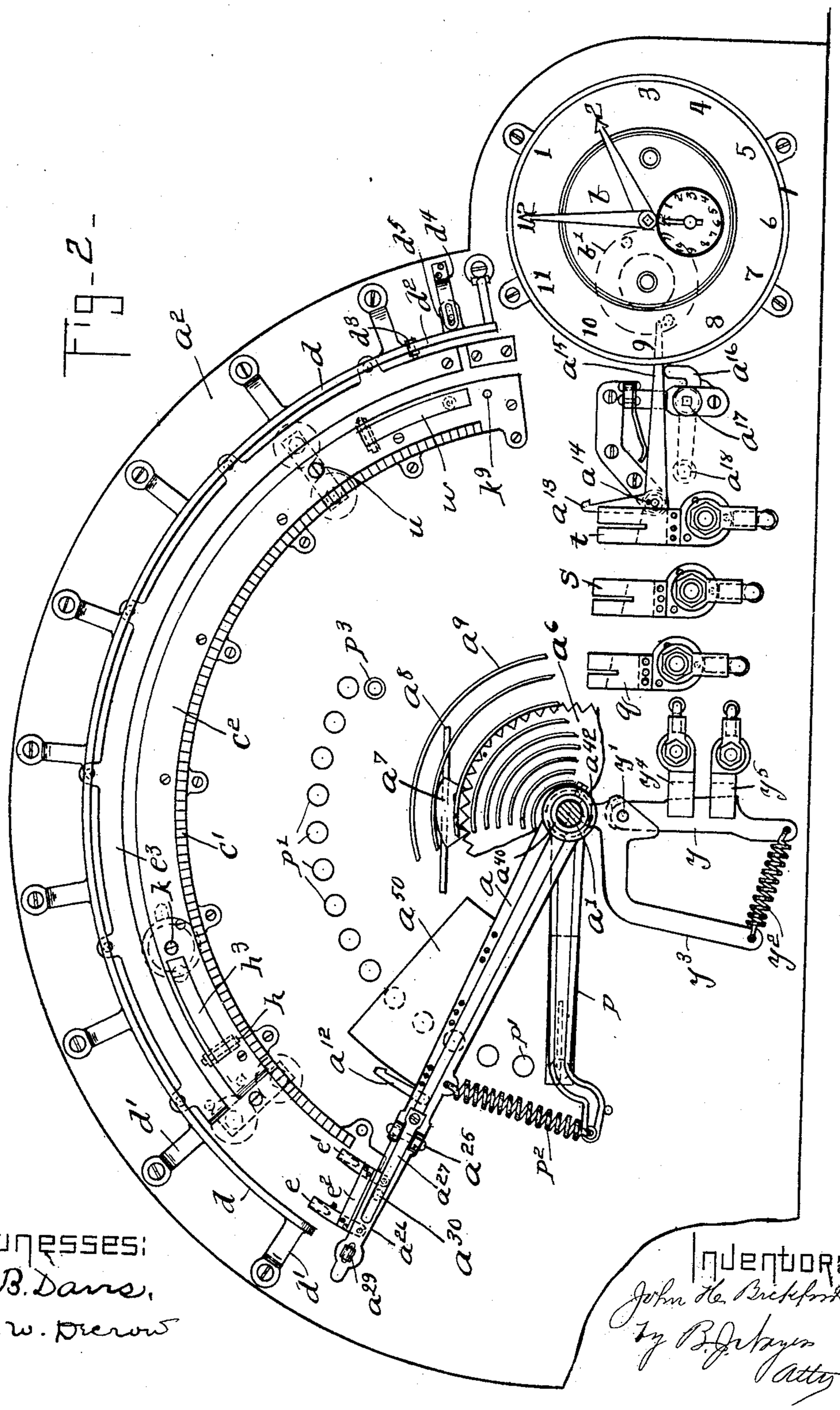
Fig. 2.



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CONTROLLING DEVICE FOR ELECTRIC GENERATING SYSTEMS.

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(No Model.) 4 Sheets—Sheet 3.

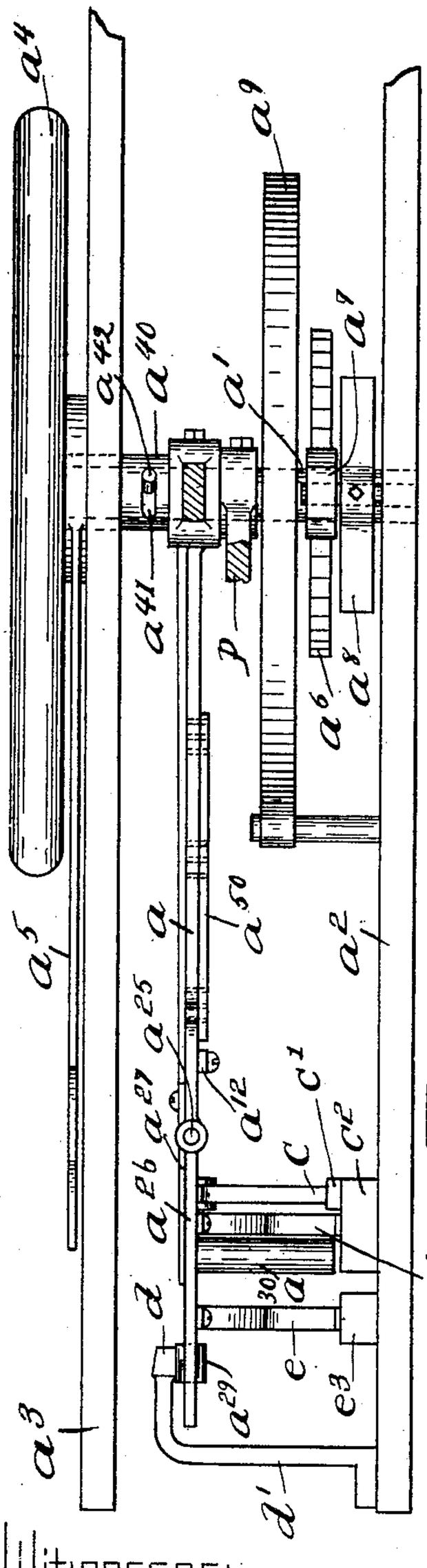

FIG. 3.

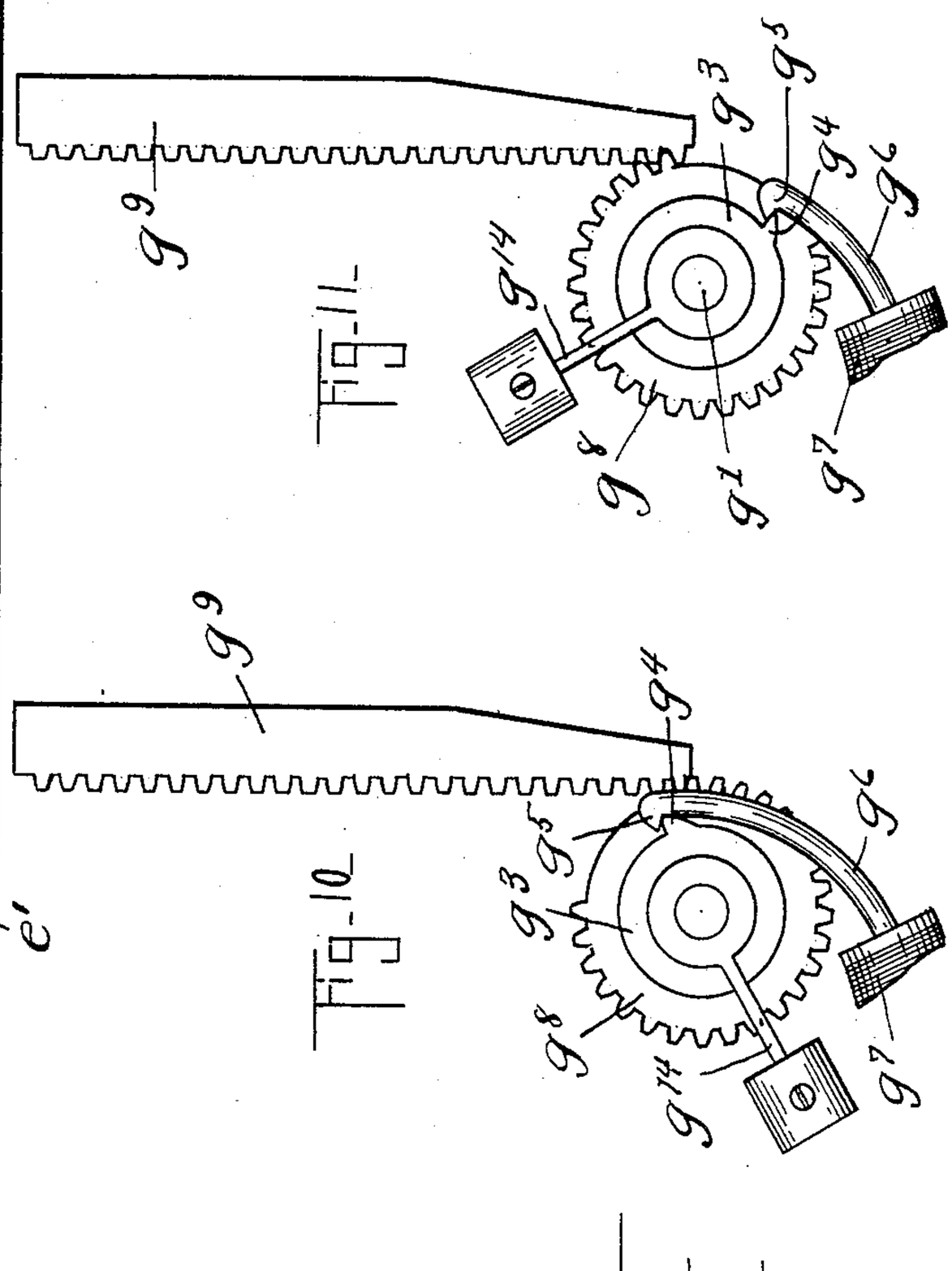

FIG. 11.

FIG. 10.

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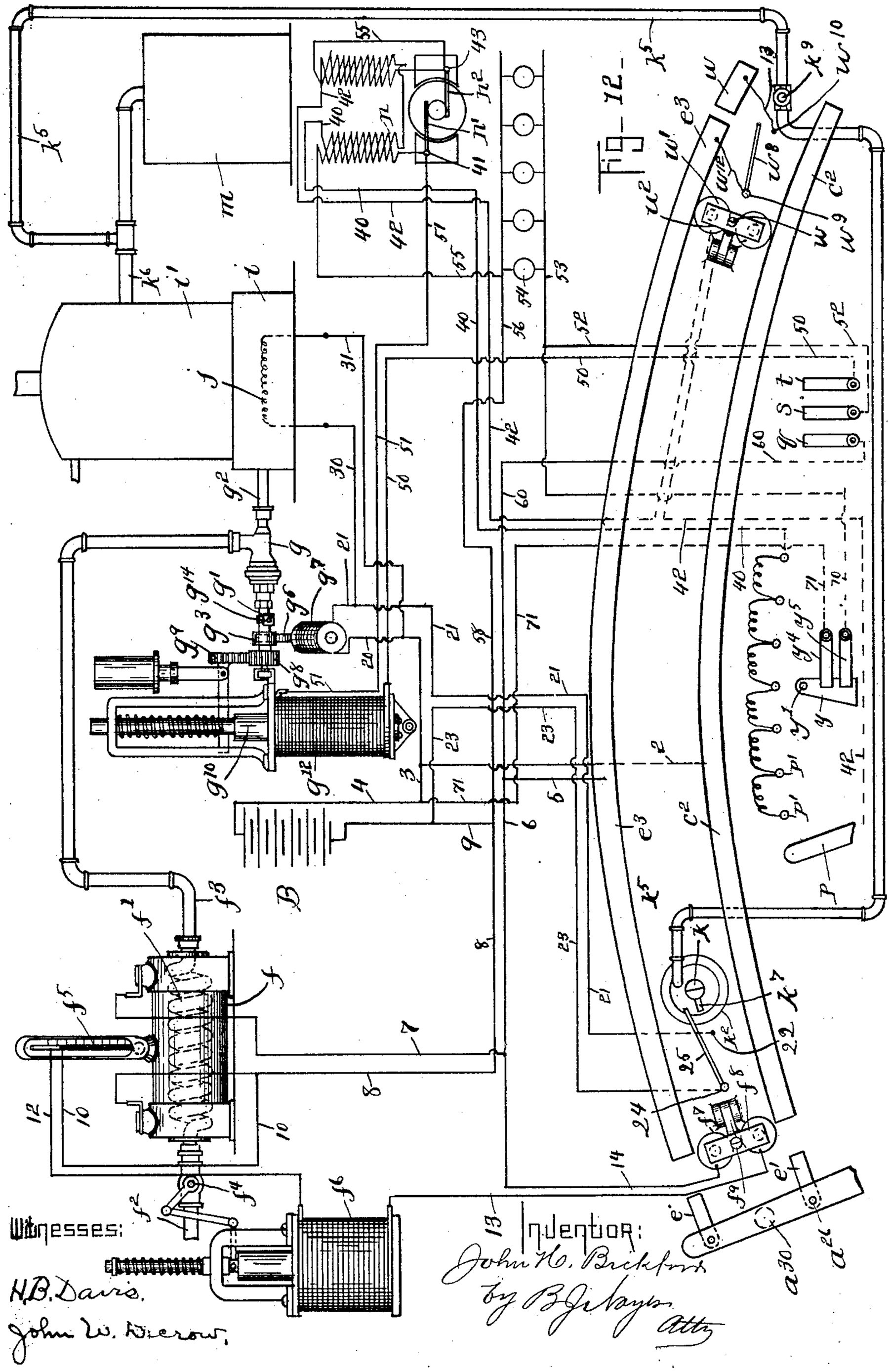
(No Model.) 4 Sheets—Sheet 4.



UNITED STATES PATENT OFFICE.

JOHN H. BICKFORD, OF SALEM, MASSACHUSETTS.

CONTROLLING DEVICE FOR ELECTRIC GENERATING SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 708,195, dated September 2, 1902.

Application filed December 18, 1900. Serial No. 40,251. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. BICKFORD, of Salem, county of Essex, State of Massachusetts, have invented an Improvement in Controlling Devices for Electric Generating Systems, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object to construct a controlling device for an electric generating system which may be located at a distant point and operated by an unskilled person to start the electric generating system in operation.

The invention consists in a starting device adapted to be manipulated by the operator to perform a number of successive acts, whereby the electric generating system is started.

An electric generating system to which it is proposed to apply the starting device embodying this invention comprises, essentially, a vaporizer for liquid hydrocarbon, adapted to be heated by a current from a storage battery or other source, a valve for controlling the admission of liquid hydrocarbon to said vaporizer, which is operated automatically by a thermal device, which is in turn operated by the heat of the vaporizer whenever said vaporizer is heated to a sufficient temperature to vaporize the liquid hydrocarbon, a valve which controls the admission of gas (vaporized liquid hydrocarbon) to the burner of a power generating and converting apparatus, a controlling device for regulating the delivery of gas to correspond to the output of a dynamo which is adapted to be operated by said power generating and converting apparatus, substantially as shown in my Letters Patent No. 656,165, an automatically-operated igniting device for said burner, means for cutting out the resistance in the shunt-field of said dynamo, means for closing the dynamo-circuit containing the translating devices, means for disconnecting the storage battery when the dynamo has been brought into action, means for connecting the vaporizer and hydrocarbon-controlling device in circuit with the dynamo when the storage battery has been cut off, and means for connecting the storage battery in circuit with the translating devices to operate them when the dynamo is at rest.

In accordance with this invention the starting device is provided with a main actuating-lever which is arranged to be moved in one direction—*i. e.*, forward—to perform the successive acts required in starting the electric generating system and to be returned to its normal position—*i. e.*, backward—to restore all the parts to their normal position. As herein shown, when the main actuating-lever is moved forward it will first operate a switch to close a circuit including a storage battery and the heating-coil of a vaporizer, and as soon as said switch has been closed said main actuating-lever will be locked in fixed position against movement in either direction until the vaporizer has been heated and also until the valve has been automatically opened by said vaporizer, by which the liquid hydrocarbon is admitted to the vaporizer. Then said main actuating-lever is released in order that it may be again moved onward, and as said main actuating-lever is moved onward another switch will be operated by it, by which a circuit is closed, including an electromagnetic device, by which a valve is opened which controls the supply of gas to the burner of the power generating and converting apparatus, and as soon as said switch has been operated said starting-lever is again locked in fixed position until steam has been generated in the steam-generator, which forms a part of said power generating and converting apparatus, and when the steam has been generated and reaches a certain pressure said main actuating-lever will be again released in order that it may be again moved onward, and as said main actuating-lever is again moved onward it operates suitable means whereby the storage battery is disconnected and a dynamo is brought into action and the dynamo-circuit, including the translating devices, closed. A locking device is also preferably provided for the main actuating-lever, which engages and holds it in fixed position while the dynamo is "building up" before the dynamo-circuit, including the translating devices, is closed, which will be operated in case said main actuating-lever is moved too quickly, said locking device being

thereafter operated automatically to disengage said main actuating-lever at the proper time. At or about the same time that the main actuating-lever brings the dynamo into action it also connects the vaporizer and hydrocarbon-controlling device with the dynamo-circuit in order that said devices may be operated by the dynamo when the storage battery is cut out. The main actuating-lever is prevented from backward movement at all times during its forward movement. When it is desired to stop the electric generating apparatus, the main actuating-lever is returned to its starting-point and all of the parts restored to their normal positions and the storage battery connected in circuit with the translating devices to operate them when the dynamo is disconnected.

Figure 1 shows in front elevation a controlling device for electric generating systems embodying this invention. Fig. 2 is an enlarged view, as compared with Fig. 1, of the apparatus, the front plate being removed. Fig. 3 is a sectional detail of the main actuating-lever and means for operating it. Fig. 4 is a detail of the switch which is operated by the main actuating-lever to open the gas-cock and ignite the burner. Fig. 5 is a detail of the switch which is operated by the main actuating-lever to disconnect the storage battery from the vaporizer and controlling device for the liquid hydrocarbon. Figs. 6, 7, and 8 are details of the locking device for the main actuating-lever, which holds said lever in fixed position while the steam is being generated and raised to a predetermined pressure. Fig. 9 is a detail of the means for manipulating the main actuating-lever at the end of its forward stroke, whereby it shall return in a different plane. Figs. 10 and 11 are details of the device for opening the valve controlling the admission of gas to the burner. Fig. 12 is a diagram of the apparatus and its circuits.

The main actuating-lever of the starting device is herein shown as an arm a, secured to a sleeve a^{40}, mounted on a spindle a', which has its bearings in the back and front plates a^2 a^3 of a box or case, and said main actuating-lever and other parts with which it coöperates are contained in said box or case, and said main actuating-lever is herein shown as adapted to be moved to and fro a part of a circle in a plane in parallelism with the back and front plates of the box and to successively perform the several acts required for starting the electric generating apparatus as it travels in one direction and to restore all the parts to their normal positions as it returns. One end of the sleeve a^{40} projects through the front plate a^3 of the box or case and has secured to it a hand-wheel a^4, by which it is turned to in turn positively move the main actuating-lever in one direction, and to said projecting end of the sleeve a^{40} a pointer a^5 is also secured, which as the sleeve is turned travels over a dial or index on the front plate a^3 of the box, thereby at all times indicating the position of the main actuating-lever.

The hand-wheel a^4, as herein shown, serves as and constitutes the operating device for the starting device; yet so far as my invention is concerned I do not desire to limit it to the employment of an operating device of this description.

I prefer to turn the main actuating-lever in one direction by means of the hand-wheel a^4 to start the electric generating apparatus and to return said main actuating-lever to its starting-point automatically, and to provide for thus automatically returning said main actuating-lever a restoring-spring is employed, which, as herein shown, is connected to the spindle a'.

The sleeve a^{40} has at its lower end a slot a^{41}, which receives a pin a^{42}, projecting laterally from the spindle a', and by means of this connection the spindle a' is turned on its axis by the hand-wheel a^4. The slot a^{41} is made long enough for the sleeve a^{40} to turn independent of the spindle for a short distance for purposes to be hereinafter described and to then engage and turn the spindle.

A restoring-spring a^9 is attached at one end to the spindle a' and at the other end to a fixed point, and when the spindle is turned in one direction by the hand-wheel a^4 said spring will be wound up, so as to act to turn the spindle in the opposite way when permitted so to do. It is desirable that the spindle a' shall be turned slowly in both directions. Hence a retarding device is provided for it, consisting, as herein shown, of an escape-wheel a^6, secured to the spindle a', which is engaged by a suitable pallet a^7, secured to a shaft bearing a fan a^8.

When the arm a has been moved by the hand-wheel a^4 from its starting-point to the position it will occupy when the electric generating apparatus is started, it is necessary to hold it in such position during the time said apparatus is in operation, and to accomplish this result means are provided for locking the main actuating-lever at the end of its forward stroke. As herein shown, the arm a has attached to it a dog a^{12}, which is adapted to engage a detent-arm a^{13}, pivoted at a^{14} and forming one arm of a bell-crank lever, the other arm a^{15} of which is arranged to be operated both automatically and manually. The detent-arm a^{13} is disposed so as to be engaged by said dog a^{12} when the arm a has been moved its full stroke for starting the complete apparatus to thereby lock said arm a in such position with the restoring-spring a^9 under tension, and said arm a will remain in such position until the detent-arm a^{13} is operated to release it. To operate the detent-arm a^{13}, and thereby release the arm a, a suitable prop a^{16} is located beneath said arm a^{15}, which is pivoted at a^{17} to a suitable bracket, and a finger-piece a^{18} is attached to said prop, which serves as a means for moving it on its pivot

to thereby lift the arm a^{15} and move the detent-arm a^{13} out of engagement with the dog a^{12}. The finger-piece a^{18} projects through a slot in the front plate of the box, so as to be readily accessible. Additional means are furthermore provided for moving said detent-arm a^{13} automatically at a predetermined time, which, as herein shown, consists of a clock-train b, having one of its wheels, as b', provided with a laterally-projecting stud, which as said wheel revolves engages the arm a^{15} and moves the detent-arm a^{13} out of engagement with the dog a^{12}. The clock-train will be of any usual construction and will be set so as to have its wheel b' operate to lift the arm a^{15} at any predetermined time.

It is important to prevent any backward movement of the arm a when traveling forward to start the apparatus, and to accomplish this result said arm a has attached to it a pawl c, which engages ratchet-teeth c', formed on a semicircular bar c^2, secured to the back plate a^2. The pawl c may be made as a gravitating pawl, which is pivoted to the under side of the arm a. During the travel of the arm a forward from its starting-point to the point where it becomes engaged by the detent-arm a^{13} the pawl c will continuously engage said ratchet-teeth c'; but on the return movement of said arm a the pawl c will be lifted out of engagement with said teeth, so that said arm may be returned by means of the restoring-spring a^9, moving slowly as it returns by reason of the escapement mechanism which is connected with it. To lift the pawl c out of engagement with the ratchet-teeth during the homeward travel of the arm a, said arm a is divided in two parts, which are hinged together at a^{25} and disposed in alinement, one of said parts, as a^{26}, being a forward extension of the other, and said forward extension a^{26} is normally held in the same plane occupied by the part to which it is attached by means of a flat spring a^{27}, which is attached to the arm at one side of the hinge, its free end bearing upon said forward extension a^{26}. When the arm a travels forward, its forward extension a^{26} will occupy its normal plane, as shown in Fig. 3; but when said arm returns homeward said forward extension a^{26} will be lifted high enough for the pawl c to disengage the ratchet-teeth c'. To positively insure the extension a^{26} of the arm a occupying its normal plane during the entire forward movement of the arm and to lift said extension and hold it elevated during the entire homeward movement of the arm, a rail or bar d is provided, which is made semicircular in form and which is supported in elevated position upon the back plate a^2 by a number of stands d', and said elevated rail d is so located relative to the arm a as to be engaged by a friction-roll a^{29}, borne by the forward extension a^{26} of said arm. As the arm a travels forward its extension a^{26} passes along the under side of the rail d, and as said arm travels homeward its extension a^{26} passes along the top of said rail, being held by said rail in position for the pawl c to engage the ratchet-teeth during the forward movement of the arm and also held by said rail with its pawl out of engagement with the ratchet-teeth during the homeward movement of the arm. An inclined portion d^2 is provided at one end of the rail d, (see Fig. 9,) which is pivoted to said rail d at d^3 or is otherwise supported, and said inclined portion is made as a continuation of the rail d and is held down in its inclined position by means of a spring d^4, (see Fig. 2,) attached to the back plate a^2, the free end of which bears upon a lug d^5, projecting from said pivoted inclined portion d^2. The pivoted inclined portion d^2 when thus held down by the spring d^4 occupies a position crossing the path of movement of the extension a^{26} of the arm when said arm is traveling forward and is passing along the under side of the rail d, so that as it passes by or beyond the end of said rail d it will engage said pivoted inclined portion d^2 and lift it, after which said pivoted inclined portion d^2 will fall back to its normal position. On the return movement of said arm a the extension a^{26} first engages said inclined portion d^2, and by it is lifted into position to engage the top of the rail d, and as said arm a returns said extension will follow along the top of said rail d until it arrives at its starting-point, when it slips off said rail d and resumes its normal position, and it will be observed that as the arm a thus travels homeward the pawl will be held out of engagement with the ratchet-teeth.

The main actuating-lever a has attached to its extension a^{26}, but insulated therefrom, a pair of contact-pens e e', which are connected together by a cross-piece e^2; yet said contact-pens and cross-piece may all be made of one piece, and said contact-pens project laterally from the lever and are located a short distance apart and in parallelism, and they are adapted to engage two semicircular plates c^2 e^3 as the lever travels forward. The semicircular plates c^2 and e^3 are both secured to the back plate a^2 in parallelism and concentric to the spindle a', and they are insulated from each other by said back plate and are electrically connected by circuit-wires with a storage battery B or equivalent apparatus—as, for instance, a wire 2 (see Fig. 11) leads from the plate c^2 to a wire 3, which leads to a wire 4, which leads to one pole of the battery B, and a wire 5 leads from the plate e^3 to a wire 6, which leads to a wire 7, connected to a coil f, and a wire 8 leads from said coil f to a wire 9, which is connected to the other pole of said battery B. Thus while the contact-pens e and e' are in engagement with the semicircular plates c^2 e^3 the circuit thus described will be closed. The coil f contains within it a coil of pipe f', (see dotted lines, Fig. 12,) which is connected at one end to a conducting-pipe f^2 and at the other end to a delivery-pipe f^3, and said coil of pipe f' is de-

signed to receive liquid hydrocarbon from the pipe f^2 and be heated by the coil f to thereby vaporize said liquid hydrocarbon in order that it may be delivered as a vapor by the pipe f^3. The coil f therefore serves as a heating-coil for the vaporizer.

A valve f^4 is contained in the conducting-pipe f^2, which is adapted to be automatically opened in order that the liquid hydrocarbon may be delivered to the vaporizer, and to accomplish this result a thermal device f^5 is provided on the vaporizer, which is adapted to be operated by the heat of the coil f, and said thermal device is herein shown as a thermometer having a pair of electric contacts adapted to be closed by the mercury rising in the tube, yet of course any other form of thermal device may be employed. One of the contacts of the thermal device is connected by a circuit-wire 10 to the wire 8, and the other contact is connected by a circuit-wire 12 to the coil f^6 of a solenoid, and a wire 13 leads from said solenoid to an electromagnet f^7, and a wire 14 leads from said electromagnet f^7 to the wire 6. The loop-circuit 10 12 13 14 is thus electrically connected with the battery B, so that the electromagnetic devices included therein will be operated whenever the circuit-wires 10 and 12 are closed by the thermal device. The contacts are disposed so that said circuit-wires 10 and 12 will be closed when the temperature of the vaporizer has reached a temperature sufficient to vaporize the liquid hydrocarbon and not before. The armature of the solenoid f^6 is connected with the valve f^4, so that said valve will be operated by said armature, being opened whenever said armature is attracted and closed whenever said armature is retracted. It will thus be observed that when the main actuating-lever is moved forward and its contact-pens e e' close the battery-circuit the coil f will begin to heat the vaporizer, and as soon as the temperature has reached a point sufficient to vaporize the liquid hydrocarbon the thermal device will act and close the loop-circuit, including the solenoid f^6, and the valve f^4 will be opened, admitting liquid hydrocarbon to the vaporizer. When the main actuating-lever has been moved forward far enough for its contact-pens e e' to close on the plates c^2 e^3, a locking device is brought into action, which prevents further onward movement of said main actuating-lever until the vaporizer has operated. The locking device herein shown for accomplishing this result consists of an electromagnet f^7, included in the loop-circuit containing the solenoid f^6, and which is operated by the thermal device closing the circuit-wires 10 and 12, and the armature f^8 of said electromagnet f^7 bears a projection or stud f^9, which when the armature is in its retracted position obstructs the path of movement of the starting-lever by engaging a stud a^{30} thereon. When, however, the armature f^8 is attracted, as it will be when the loop-circuit is closed, then said main actuating-lever will be released. As soon as the main actuating-lever is released it may be moved onward, and as it is thus moved it next operates suitable means whereby a valve is operated which controls the supply of hydrocarbon to the burner of the power generating and converting apparatus.

The valve which controls the supply of hydrocarbon to the power generating and converting apparatus is herein represented as contained in the valve-case g and having a stem g', which when turned in one or the other direction opens and closes the way. The valve-case g is connected with the delivery-pipe f^3 from the vaporizer and with the pipe g^2, which is connected with the burner. (Not shown.) The valve-stem g' has secured to it a disk g^3, which is formed or provided with a projection g^4, which is normally engaged by the hooked end of an arm or lever g^5, formed on or attached to the armature g^6 of a solenoid g^7, and as the armature of said solenoid is attracted the disk g^3 will be turned to in turn partially rotate the valve-stem g' and open the way. The disk g^3 is constructed in the manner shown, so that the valve-stem g' may be further rotated by other means to be described independently of said solenoid g^7. A mutilated pinion g^8 is also secured to said valve-stem g', the teeth of which are adapted to be engaged by a rack-bar g^9, attached to the armature g^{10} of a solenoid g^{12}, substantially as shown in my Patent No. 656,165, before referred to, and said rack-bar is designed to operate said pinion g^8, and thereby further rotate the valve-stem g' independently of the solenoid g^7. In practice the solenoid g^7 is energized first and the valve-stem g' turned to open the way, and afterward the solenoid g^{12} is energized and the solenoid g^7 cut out, and while said solenoid g^{12} is energized the way will be opened more or less, according to the output of the dynamo. As soon as the solenoid g^7 is cut out its armature returns into position to again engage the projection g^4. A weighted arm g^{14} is attached to the valve-stem, which is employed as a means of turning said valve-stem to close the way, when the solenoid g^{12} is cut out and its armature g^{10} retracts and the pinion g^8 returns to a position whereby the mutilated portion thereof will disengage the rack-bar.

In Fig. 10 the parts are represented in the position they will occupy when the way is closed, and in Fig. 11 said parts are represented in the position they will occupy when the way is open by means of the solenoid g^7 and is in the position to be further opened by the solenoid g^{12}. The solenoid g^7 is included in a loop-circuit comprising a circuit-wire 20, which leads from the coil of the solenoid to the wire 3 and thence to the battery by wire 4, and also a circuit-wire 21, which leads from the solenoid to one point 22 of a switch, and a wire 23, which leads from the other point 24 of said switch to the wire 9 and thence to

the battery, and said loop-circuit is operated by the switch-arm 25, coöperating with said points 22 and 24, and whenever said switch is closed the loop-circuit will be closed and the solenoid operated.

The switch-arm 25 is herein shown (see Fig. 4) as pivoted at h to the back board a^2 and having a short arm h' projecting from it, the extremity of which is loosely connected by a link h^2 with one end of a lever h^3, pivoted at h^4 at a point substantially midway its length, said lever being bent at substantially right angles and disposed to project through an opening in the back board, so as to occupy a position in the path of movement of the stud a^{30} on the main actuating-lever. The switch is normally held open and the lever h^3 normally held in position to be engaged by the stud a^{30} by means of a spring h^5, connected to a short arm h^6, which forms the extension of the lever h^3; but when said stud a^{30} engages said lever h^3 and depresses it the switch-arm 25 is thrown into engagement with the points 22 24 and the loop-circuit closed. The switch 22 24 25 is made on the plan of an ordinary jump-switch for obvious reasons and will be instantly opened whenever the lever h^3 is released. As soon as the loop-circuit containing the solenoid g^7 is closed and the valve g opened the hydrocarbon passes to the burner, which is contained in the shell or case i of a steam-generator i' of any suitable construction, and to ignite it automatically an igniting device is provided, which, as herein shown, consists of a coil j, of platinum wire or equivalent material, which is connected in a loop-circuit comprising a circuit-wire 30, which leads from one end of the coil j to the wire 21, and the circuit-wire 31, which leads from the other end of the coil j to the wire 20, and as said circuit-wires 20 and 21 are connected with the battery B and operated by the switch 22 24 25 it will be seen that when the loop-circuit comprising said wires 20 and 21 is closed by said switch said igniting device will also be operated. It is designed and intended that the main actuating-lever shall act to hold said switch 22 24 25 closed while the steam is being generated in the steam-generator i', and to provide for the accomplishment of this result a locking device is provided for holding said main actuating-lever, and, as herein shown, said locking device consists of a projection k, (see Fig. 6,) rising from the piston-like disk k', contained in a cylinder k^2, said disk being normally held in its elevated position by means of a spring k^3 and adapted to be pressed down against the action of said spring by the pressure of steam in the steam-generator. The projection k is located in the path of movement of the stud a^{30} on the main actuating-lever, so as to be engaged by said main actuating-lever when it occupies a position whereby it is holding the lever h^3 pressed down. The steam is admitted to the cylinder k^2 through a pipe k^5, which is connected to a pipe k^6, leading from the steam-generator. Thus it will be seen that as soon as the steam-pressure has reached a predetermined point the piston-like disk k' in the cylinder k^2 will be pressed down and the projection k removed from the path of movement of the main actuating-lever, and said main actuating-lever being thus released is free to be moved onward in its course. As the main actuating-lever is moved onward in its course the switch-lever h^3 would immediately rise and open the switch if means were not provided for preventing such action, and if the switch-lever h^3 should open the circuit at this particular time the valve g would be closed and the gas shut off from the burner, because the solenoid g^{12} has not at this time been included in the circuit which is designed to operate it. Hence means are provided for holding said switch-lever h^3 down and the switch closed after the main actuating-lever has passed by the locking device k and until such time as the solenoid g^{12} shall have been duly energized, and, as herein shown, the projection k has formed on it a spiral groove k^{20}, which receives a pin k^{21}, secured to and projecting inwardly from the top wall of the cylinder k^2, so that as said projection k descends it will be turned on its axis a partial revolution for purposes to be explained. The projection k has also formed upon or secured to it a laterally-projecting bent pin k^7, which is adapted to coöperate with or engage a lateral projection k^8 on the switch-lever h^3. In operation the switch-lever h^3 will be depressed and will be held down by the main actuating-lever while said lever is bearing against the pin k. Then as said pin k descends to release the main actuating-lever it turns on its axis, so that the lateral projecting pin k^7 will pass over the top of the projection k^8, and thereby hold said switch-lever h^3 depressed positively until such time as the steam is shut off from the cylinder. If, however, the steam should be admitted to the cylinder while the switch-lever h^3 is in its elevated position, the projection k will descend and turn on its axis while descending, and in such case the bent pin will pass beneath the lateral projection k^8 on the switch-lever h^3. In the pipe k^5, leading from the pipe k^6, is a valve k^9, of any suitable description, which is so disposed as to be engaged and operated by a stud a^{30} on the main actuating-lever at the proper time and to close said valve to thereby shut off the steam from the cylinder k^2, and when the steam is thus shut off the piston will be raised by the spring contained in said cylinder, and the switch-lever h^3 will consequently be released.

m is intended to represent a steam-engine of any suitable construction which is operated by the steam from the steam-generator i', and said engine is adapted to operate a dynamo n, which also may be of any suitable construction. The steam having been generated

and brought to the required pressure, the steam-engine started, and the dynamo also started, the next act to be performed by the main actuating-lever a is to bring the dynamo into action. The dynamo n, as herein shown, is a common form of compound-wound machine, and to bring it properly into action the resistance of its shunt field-circuit must be cut out.

p represents a rheostat contact-arm, which is rigidly secured to the spindle a', and said contact-arm is adapted to move in a plane in parallelism with the main actuating-lever a and to pass over and successively engage a number of contacts p' on the back board a^2, said contacts forming a part of the rheostat or resistance which is included in the shunt field-circuit of the dynamo n. The rheostat contact-arm p is connected with the main actuating-lever a by means of a spiral spring p^2, yet said spring is not provided for the purpose of moving said contact-arm, as said arm is rigidly connected with the spindle a'. As the main actuating-lever a is moved from its starting-point the spring p^2 will be more or less extended, as it is weaker than the restoring-spring a^9, and the contact-arm p will therefore remain at rest until said main actuating-lever has been moved far enough for the sleeve a^{40} to engage the pin projecting laterally from the spindle a', and it is not intended that said contact-arm shall start until the steam has been generated. With the spring p^2 thus extended the contact-arm p is then moved by the main actuating-lever positively engaging and turning the spindle, and as it moves it passes over the several contacts p' and cuts out the resistances in the shunt field-circuit of the dynamo. The relative positions of the main actuating-lever and contact-arm will remain the same even when the main actuating-lever has completed its forward stroke and is engaged by the detent-arm a^{13}, and at such time the contact-arm will bear against the stop p^3. The spring p^2 therefore subserves no function during the forward stroke of the main actuating-lever. As the main actuating-lever completes its forward stroke a blade a^{50}, carried by it, engages the switch-plates q, s, and t, and being then locked by the detent-arm a^{13} will remain in engagement with said switch-plates during the operation of the apparatus. As soon as the main actuating-lever a is released by the proper operation of the detent-arm a^{13}, it being at such time unrestrained, the spring p^2, which has been held in extended condition, will immediately draw it toward the contact-arm p, thereby instantly opening the several switches and preventing the formation of arcs. The spring p^2 therefore subserves, essentially, the function of an actuating-spring for the lever a when the latter is serving as a switch-lever. As the main actuating-lever a travels onward from the stop k the contact-arm p moves with it; but before said main actuating-lever arrives in position for its blade a^{50} to engage the switch-plates q, s, and t it must pass by or over a stop u, which is herein shown as an electromagnet u', included in the shunt field-circuit of the dynamo, having the stop or projection u on its armature u^2, and said stop or projection u normally occupies a position in the path of movement of said stud a^{30} on said lever a to engage said stop, and thereby check the onward progress of the lever. The contact-arm p is presumed to move slowly, owing to the retarding device which is connected with the spindle a', and the dynamo is supposed to generate current up to the normal pressure for which it is designed by the time the main actuating-lever a arrives at the stop u, and if such is the case then the electromagnet u' will be energized and the armature attracted and the projection u removed from the path of movement of the stud a^{30}; but if the dynamo should not build up in time, which is sometimes the case, then the stud a^{30} will engage the projection u and the main actuating-lever and contact-arm p will be held at rest until said projection u has been removed.

The shunt field-circuit of the dynamo is herein represented as the circuit-wire 40, leading from the resistances to the point 41 on the contact-brush n' of the dynamo, and the circuit-wire 42, leading to the point 43 on the contact-brush n^2 of the dynamo, and the electromagnet u' is included in said circuit-wire 42, and it will be seen that while the contact-arm p is in engagement with the contacts p' said shunt field-circuit will be closed. During the time the main actuating-lever a is moving step by step to perform the several acts required to start the steam-generator, steam-engine, and dynamo the storage battery B is employed for the purpose of supplying the necessary current to do the work; but after the dynamo has been brought into action the said storage battery B is cut out just before or as the dynamo-circuit is closed, after which time the vaporizer and controlling device for regulating the supply of hydrocarbon to the burner will be operated by the dynamo. As herein shown, the storage battery B is cut out just as the dynamo-circuit is closed—*i. e.*, just as the blade a^{50} on the main actuating-lever closes on the switch-plates q, s, and t—and to accomplish this result the contact-pens $e\,e'$ are removed from engagement with the contact-strips $c^2\,e^3$. The contact-strips $c^2\,e^3$ terminate at the proper point relative to the position of the switch-plates q, s, and t for the accomplishment of this result, yet means are provided for preventing an arc being drawn when said contact-pens $e\,e'$ leave said strips. The contact-strip e^3 terminates a short distance back of the contact-strip c^2, and an independent contact-strip w is provided, which is located so as to present a continuation of said contact-strip e^3, yet leave a gap between said strips w and e^3, and as the main actuating-lever travels along the contact-pen e' will continue in engagement with

the contact-strip c^2, while the contact-pen e will leave the strip e^3, cross the gap, and pass on to the strip w, and finally the two contact-pens e e' will disengage said contact-strips c^2 and w at or about the same time and just as the blade a^{50} engages the switch-plates q, s, and t. The contact-strip w is attached to the back board a^2 and insulated from the other contact-strips. A switch w' is provided which is adapted to close an electrical connection between said contact-strips e^3 and w while the pen e is crossing the gap between said strips e^3 and w, which afterward operates and breaks said electrical connection while the pen e is on the strip w. The switch w' consists of a pivoted lever located in the path of movement of the stud a^{30} on the main actuating-lever and is properly disposed to be operated by said stud to close the circuit while the pen e is crossing the gap between the strips e^3 and w. The pivoted lever of the switch w' (see Fig. 5) has an arm w^2 depending from it, which is connected by a spring w^3 with the back board, said spring serving to normally hold the lever in its elevated position, and said lever also has depending from it an arm w^4, the lower end of which is loosely connected with one end of a lever w^5, pivoted at w^6 to an arm w^7, and said lever w^5 carries a blade w^8, which is adapted to engage switch-plates w^9 w^{10}, from which the circuit-wires lead, one circuit-wire, as w^{12}, leading to the contact-strip e^3 and the other circuit-wire, as w^{13}, leading to the contact-strip w. Whenever this switch is closed by the main actuating-lever, the contact-strips e^3 and w will be electrically connected together. When the blade a^{50} on the main actuating-lever is brought into engagement with the switch-plates q, s, and t, said switch-plates will be electrically connected together, and the dynamo-circuit, together with the circuit including the translating devices, and also the circuit including the controlling device for regulating the supply of hydrocarbon to the burner, and also the circuit including the vaporizer, will be closed. From the plate t a circuit-wire 50 leads, which is connected to the solenoid of the controlling device for the hydrocarbon, and a wire 51 leads from said solenoid to the dynamo at 41. From the plate s a wire 52 leads, which is connected to one of the wires 53, including the translating devices, and a wire 55 leads from the other wire 56 of the circuit including the translating devices, which leads to the dynamo at 43 and forms the compound coil of the dynamo. Thus it will be seen that when said plates s and t are electrically connected together the dynamo-circuit including the translating devices and also including the controlling device for the hydrocarbon is closed. From the plate q a wire 60 leads, which is connected to the wire 6 and by the wires 7 and 8 is connected to wire 58, which is connected with the wire 56, so that the vaporizer is included in circuit to be operated by said dynamo n.

When the main actuating-lever a returns to its normal position or starting-point, which it will do automatically when released by means of the restoring-spring a^9 as its extremity is lifted, so that the pawl is held out of engagement with the ratchet-teeth c', the contact-pens e e' will also be held out of engagement with the contact-strips, and the said stud a^{30} will pass over freely the several stops and switch-levers. When the main actuating-lever is in its normal position and the dynamo n at rest, it is intended that the translating devices 54 shall be connected in circuit with the storage battery B, and to accomplish this result a switch-arm y is pivotally connected at y' to a projection on the rheostat contact-arm, and the extremity of said switch-arm is connected by a spring y^2 with a bent arm y^3, projecting from said rheostat contact-arm, so that said switch-arm y will be operated by movement of said rheostat contact-arm. The switch-arm y engages a pair of switch-plates y^4 y^5. A circuit-wire 70 leads from the switch-plate y^5 to the wire 53, and a wire 71 leads from the switch-plate y^4 to the wire 4, and when the switch-arm y is closed the translating devices 54 will be included in the battery-circuit as follows: B, wires 4 71, switch-plate y^4, arm y, switch-plate y^5, wires 70 53 56 58 9 to battery. Thus it will be seen that normally the battery-circuit is closed by said switch-arm y; but when the main actuating-lever a has been moved sufficiently for the rheostat-arm p to close on the first contact p' of the resistance the said switch-arm y is disengaged from the switch-plates y^4 y^5 and said battery-circuit opened at this point, although the battery-circuit will have been previously closed by the contact-pens e e' engaging the contact-strips e^3 c^2, as previously described.

I claim—

1. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus and a device for closing the dynamo-circuit containing the translating devices having an operating device by which it is operated, substantially as described.

2. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus, a device for closing the dynamo-circuit containing the translating devices and an operating device for operating said starting device and also said circuit-closing device, substantially as described.

3. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus and a device for cutting out the resistances of the shunt

field-circuit of the dynamo and for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, substantially as described.

4. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus and a device for closing the dynamo-circuit, having an operating device by which it is operated, and an automatic locking device for holding said starting device while the power generating and converting apparatus starts, substantially as described.

5. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus and a device for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, and automatic means for preventing the starting device from closing the dynamo-circuit until after the power generating and converting apparatus starts, substantially as described.

6. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus and a device for cutting out the resistances of the shunt field-circuit of the dynamo and for also closing the dynamo-circuit containing the translating devices having an operating device by which it is operated, and an automatic locking device for preventing said device from cutting out the resistances of the shunt field-circuit of the dynamo and for closing the dynamo-circuit until after said power generating and converting apparatus has started, substantially as described.

7. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also starting said power generating and converting apparatus, having an operating device by which it is operated, substantially as described.

8. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus and a device for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, substantially as described.

9. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus, a device for closing the dynamo-circuit containing the translating devices, and an operating device for operating said starting device and also said circuit-closing device, substantially as described.

10. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus and a device for cutting out the resistances in the shunt field-circuit of the dynamo and for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, substantially as described.

11. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power and converting apparatus and for starting said power generating and converting apparatus, means for cutting out the resistances in the shunt field-circuit of the dynamo and for closing the dynamo-circuit containing the translating devices, and an operating device for operating said starting device and also said means for cutting in the dynamo and for closing the dynamo-circuit, substantially as described.

12. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also

starting said power generating and converting apparatus, having an operating device by which it is operated and an automatic locking device for holding said starting device while the power generating and converting apparatus starts, substantially as described.

13. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus and a device for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, and automatic means for preventing the circuit-closing device from closing the dynamo-circuit until after the power generating and converting apparatus has started, substantially as described.

14. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus, and a device for cutting out the resistances in the shunt field-circuit of the dynamo and for closing the dynamo-circuit containing the translating devices, having an operating device by which it is operated, and an automatic locking device for preventing the device from cutting out the resistances of the shunt field-circuit of the dynamo and for closing the dynamo-circuit until after said power generating and converting apparatus has started, substantially as described.

15. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also starting said power generating and converting apparatus, having an operating device by which it is operated, and an automatic locking device for holding said starting device while the vaporizer acts to vaporize the liquid hydrocarbon, substantially as described.

16. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also starting said power generating and converting apparatus, having an operating device by which it is operated, an automatic locking device for holding said starting device while the vaporizer acts to vaporize the liquid hydrocarbon, and another automatic locking device for holding said starting device while the power generating and converting apparatus starts, substantially as described.

17. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, and means for operating said circuits, and a switch for closing the dynamo-circuit containing the translating devices and means for operating it, substantially as described.

18. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, means for operating said circuits, and a switch for closing the dynamo-circuit containing the translating devices, and an operating device for operating said starting device and also said switch, substantially as described.

19. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, and means for operating said circuits, and means for cutting out the resistances of the shunt field-circuit of the dynamo, a switch for closing the dynamo-circuit including the translating devices and means for operating it, substantially as described.

20. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a starting device for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, and means for operating said circuits, combined with an automatic locking device for holding the starting device while the power generating and converting apparatus starts, substantially as described.

21. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, and means for operating said circuits, and a switch for closing the dynamo-circuit containing the translating devices, means for operating it, and means for preventing the operation of said switch until after the power generating and converting apparatus starts, substantially as described.

22. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a starting device for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, and means for operating said circuits, a device for cutting out the resistances of the shunt field-circuit of the dynamo, a switch for closing the dynamo-circuit containing the translating devices, means for operating it, and an automatic locking device for holding said device to prevent cutting out the resistances of the shunt field-circuit of the dynamo, and for holding the switch to prevent closing the dynamo-circuit until after the power generating and converting apparatus starts, substantially as described.

23. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, switches for said circuits, and means for operating said switches successively, substantially as described.

24. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, and switches for said circuits, and a switch for closing the dynamo-circuit, and means for operating said switches successively, substantially as described.

25. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, and switches for said circuits, and means for cutting out the resistances of the shunt field-circuit of the dynamo, a switch for closing the dynamo-circuit, and means for successively operating said battery-circuit switches, resistances and dynamo-circuit switch, substantially as described.

26. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for also starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, switches for said circuits, and means for operating said switches successively, and an automatic locking device for holding said starting device while the vaporizer acts to vaporize the liquid hydrocarbon, substantially as described.

27. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, and switches for said circuits, and a switch for closing the dynamo-circuit, means for operating said switches successively, and automatic means for preventing the switch

from closing the dynamo-circuit until after the power generating and converting apparatus has started, substantially as described.

28. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus and a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus and for starting said power generating and converting apparatus, comprising a battery, circuits leading therefrom including the operating devices which control said vaporizer and start said power generating and converting apparatus, and switches for said circuits, and a switch for closing the dynamo-circuit, means for operating said switches successively, an automatic locking device for holding said starting device while the vaporizer acts to vaporize the liquid hydrocarbon, and another automatic locking device for holding said starting device until the power generating and converting apparatus starts, substantially as described.

29. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus, having an operating device by which it is operated, and an automatic locking device for holding the starting device while the vaporizer acts to vaporize the liquid hydrocarbon, substantially as described.

30. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus, having an operating device by which it is operated, and a locking device for holding the starting device while the vaporizer acts to vaporize the liquid hydrocarbon, and a thermal device operated by the vaporizer for operating said locking device to release the starting device, substantially as described.

31. In an electric generating system, a dynamo, a power generating and converting apparatus for operating it, and a vaporizer for vaporizing liquid hydrocarbon which is delivered to said power generating and converting apparatus, combined with a starting device for controlling the admission of liquid hydrocarbon to the vaporizer and for controlling the delivery therefrom to the power generating and converting apparatus, comprising a battery, circuits leading therefrom, including the operating devices which control said vaporizer, switches for said circuits, means for operating them, and a locking device for holding the starting device while the vaporizer acts to vaporize the liquid hydrocarbon, and a thermal device operated by said vaporizer for operating said locking device to release the starting device, substantially as described.

32. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, and a starting device for starting said power generating and converting apparatus comprising an electromagnetically-operated device for controlling the admission of hydrocarbon to the burner of said power generating and converting apparatus, and an automatic igniting device for said burner, a battery, circuits leading therefrom including said electromagnetically-operated controlling device and said igniting device, and means for operating said circuits, substantially as described.

33. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, and a starting device for starting said power generating and converting apparatus comprising a vaporizer, a heating-coil therefor, an electromagnetically-operated device for controlling the admission of hydrocarbon to the burner of said power generating and converting apparatus, and an automatic igniting device for said burner, a battery, circuits leading therefrom including the heating-coil of the vaporizer, the electromagnetically-operated controlling device and said igniting device, and means for operating said circuits, substantially as described.

34. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, and a starting device for starting said power generating and converting apparatus comprising a vaporizer, a heating-coil therefor, an electromagnetically-operated device for controlling the admission of hydrocarbon to the burner of said power generating and converting apparatus, and an automatic igniting device for said burner, a battery, circuits leading therefrom including the heating-coil of the vaporizer, the electromagnetically-operated controlling device and said igniting device, means for operating said circuits, and means for disconnecting said heating-coil from the battery, and for connecting it with the dynamo-circuit, substantially as described.

35. In an electric generating system, the combination of a dynamo, a power generating and converting apparatus for operating it, and a starting device for starting said power

generating and converting apparatus comprising a battery, circuits leading therefrom including the operating devices for starting said power generating and converting apparatus, means for operating said circuits, a circuit containing the translating devices, a switch for connecting said battery with said circuit, and means for opening said switch and for connecting said circuit with the dynamo-circuit, substantially as described.

36. The combination with a movable contact-pen, of two separated contact-strips insulated from each other adapted to be successively engaged by said contact-pen, a switch for closing an electrical connection between said contact-strips, and means for closing said switch while the contact-pen traverses the gap between said contact-strips, which thereafter opens and breaks the connection, substantially as described.

37. In an electric generating system, a dynamo, a power generating and converting apparatus, a starting device for starting said power generating and converting apparatus, having an operating device by which it is operated, a detent for engaging said starting device and for holding it in its abnormal position, means for operating said detent to release the starting device and means for returning said starting device to its normal position, substantially as described.

38. In an electric generating system, a dynamo, a power generating and converting apparatus, a starting device for starting said power generating and converting apparatus, having an operating device by which it is operated, a detent for engaging said starting device and for holding it in its abnormal position, means for automatically operating said detent to release the starting device, and means for returning said starting device to its normal position, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN H. BICKFORD.

Witnesses:
B. J. NOYES,
H. B. DAVIS.