No. 656,165. Patented Aug. 21, 1900.

J. H. BICKFORD.

ELECTRIC GENERATING APPARATUS.

(Application filed Dec. 8, 1899.)

(No Model.) 2 Sheets—Sheet 1.

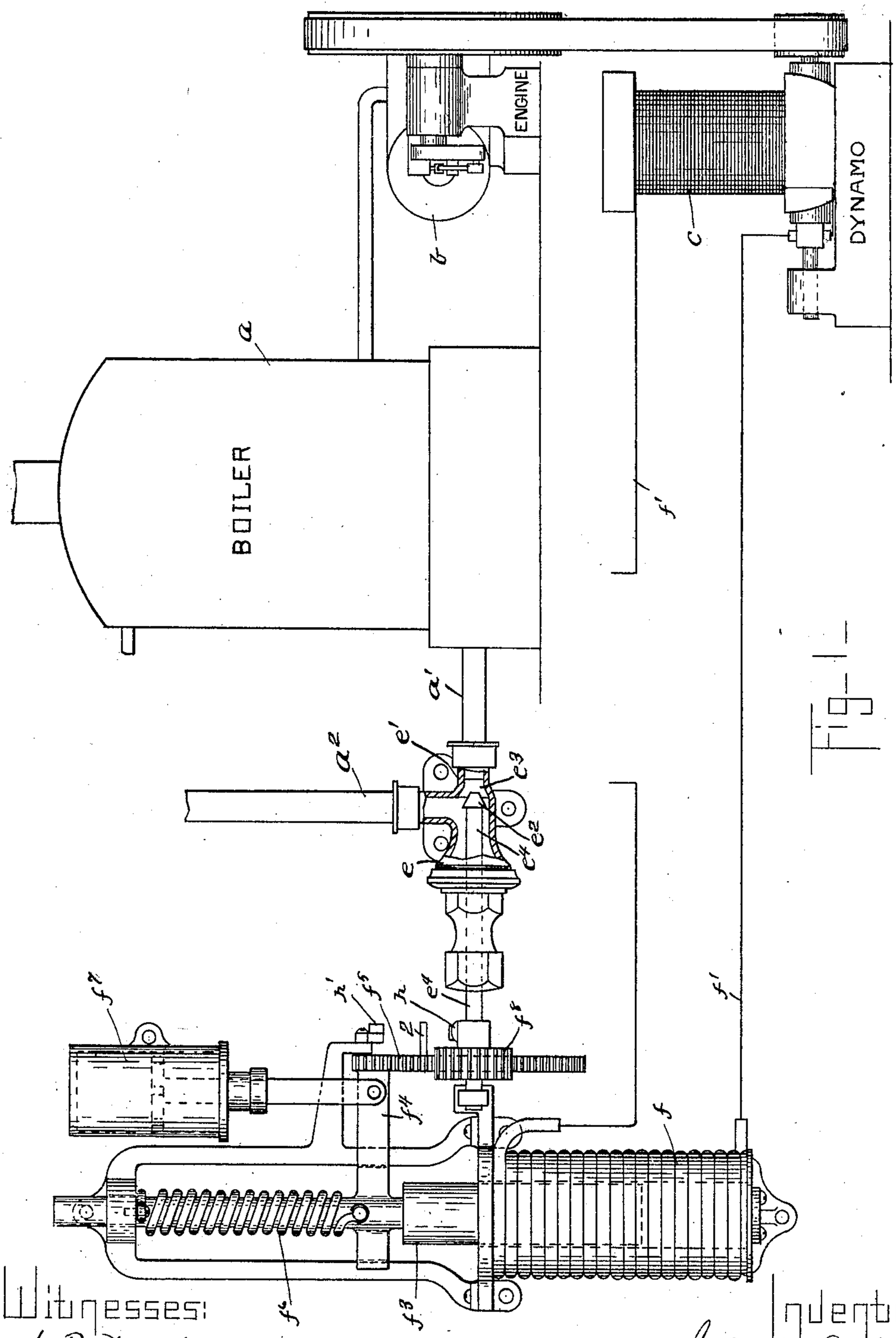

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Fig. 2.

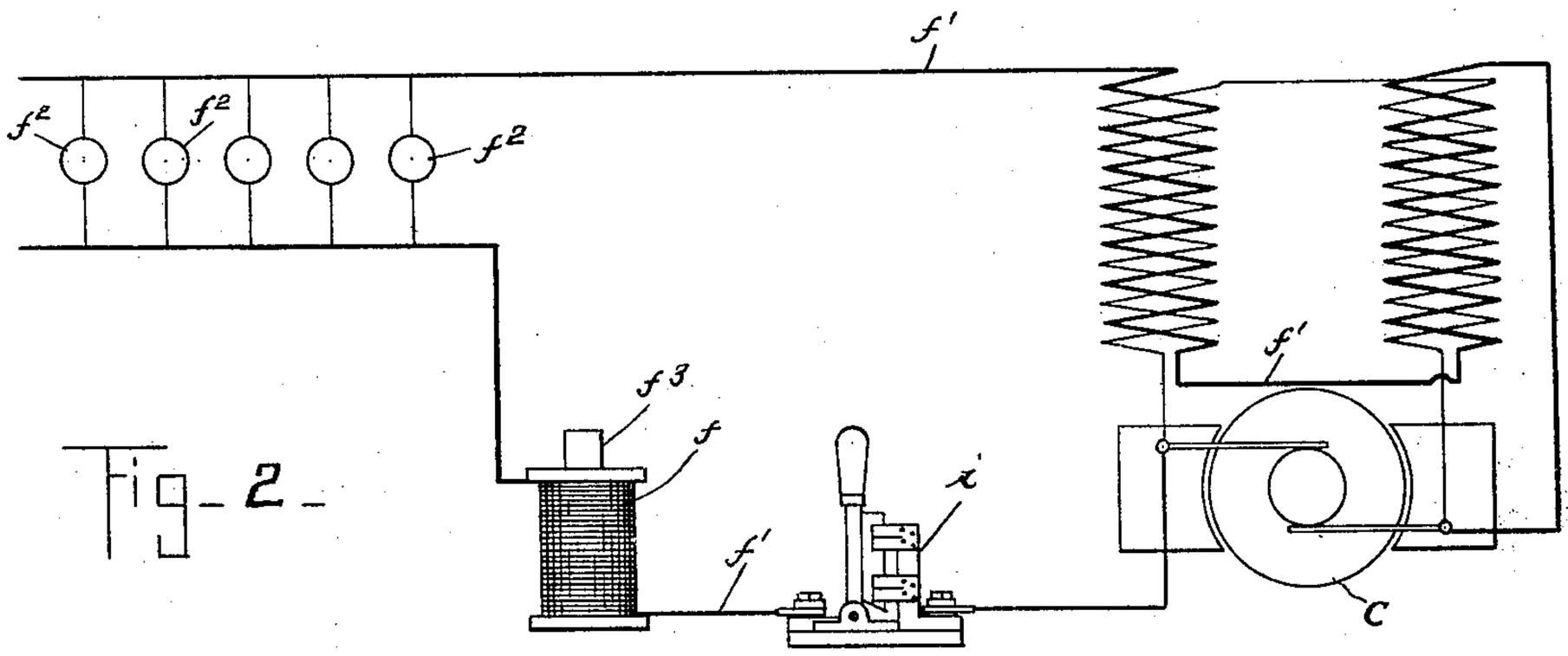


Fig. 3.

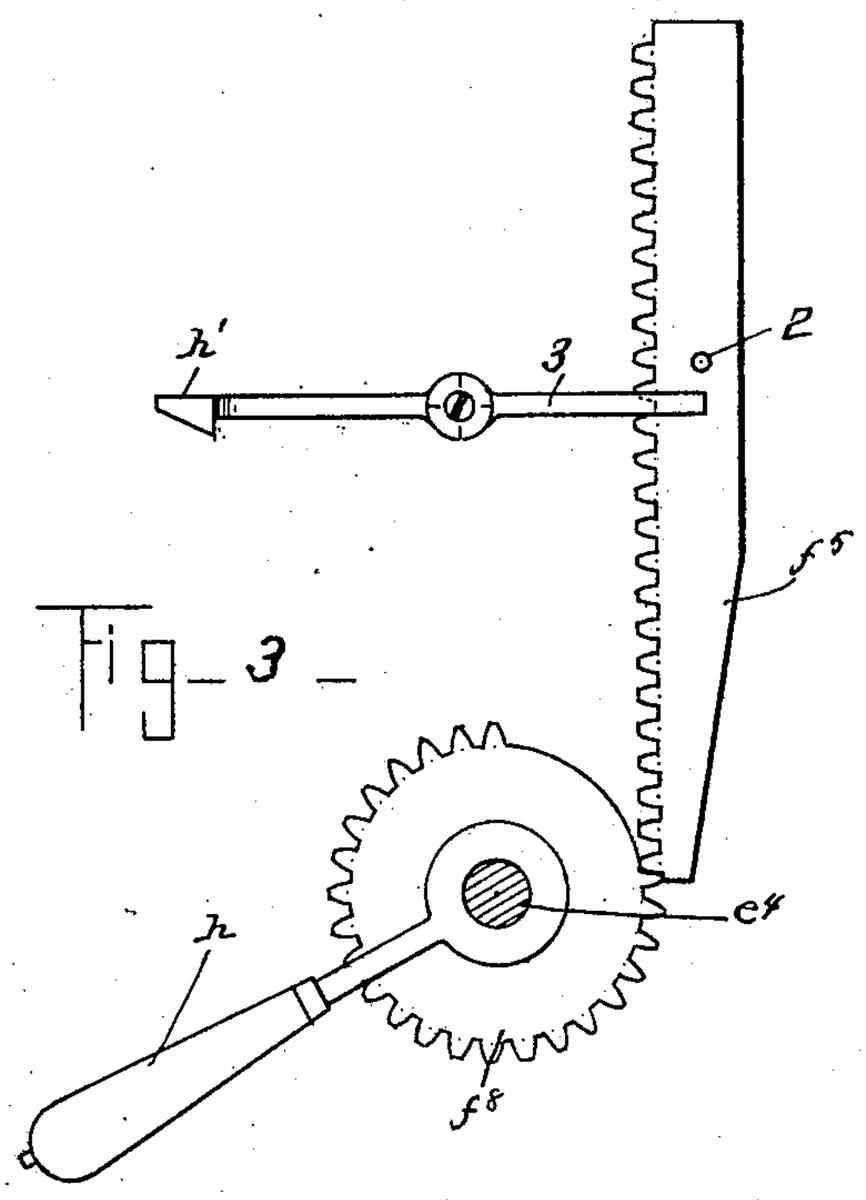
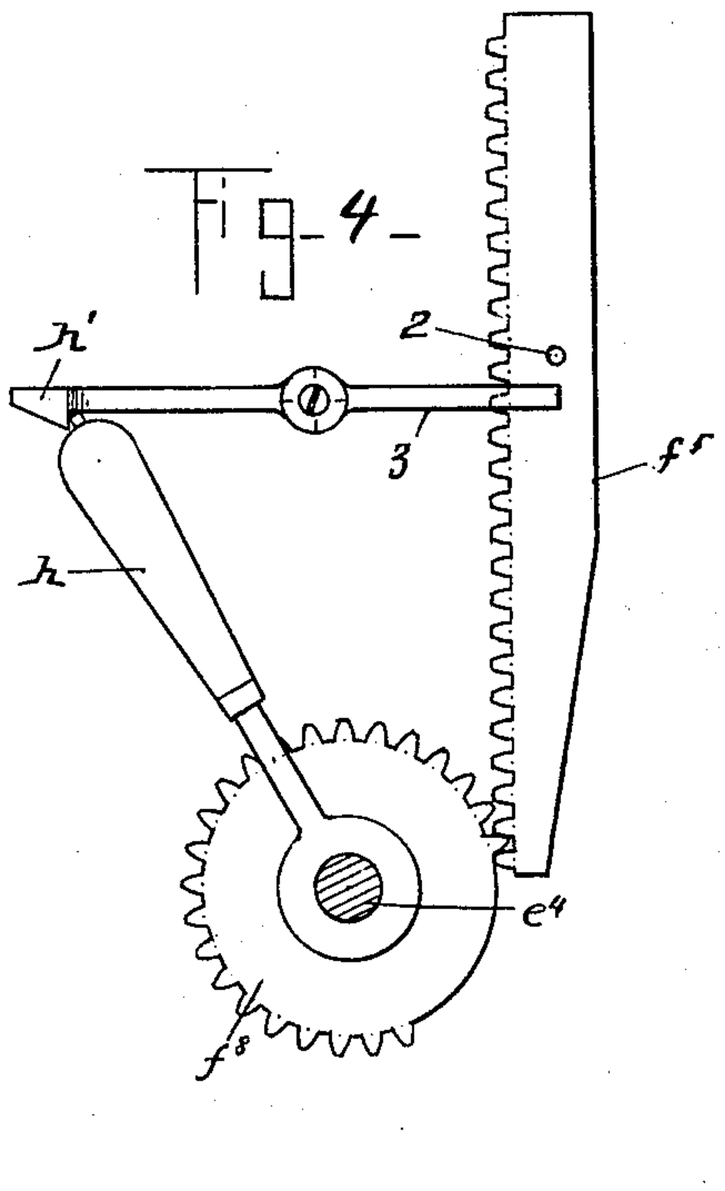


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELECTRIC GENERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 656,165, dated August 21, 1900.

Application filed December 8, 1899. Serial No. 739,677. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. BICKFORD, of Salem, county of Essex, and State of Massachusetts, have invented an Improvement in Electric Generating Apparatus, 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 an electric generating apparatus which is especially adapted for generating an electric current for an electric-lighting system comprising a small number of lamps, said electric generating apparatus having the capability of being very economically run and in many respects is automatic in its operation. Such an electric-lighting system is especially adapted for residences, stores, halls, &c., yet said electric generating apparatus may be employed for other purposes.

The electric generating apparatus comprises, essentially, a dynamo and a power generating and converting apparatus—such, for instance, as a steam-generator and engine for operating it; and the essential feature of this invention consists in providing means for varying the output of said power generating and converting apparatus which shall be operated by the circuit of said dynamo, so that as more or less current is called for the output of the power generating and converting apparatus will be correspondingly increased or decreased.

The means which I employ for varying the output of the power generating and converting apparatus is preferably automatic in its operation. In case a steam-engine is employed a steam-generator will be provided having a burner adapted for burning gas, oil, or vapor, singly or in combination, and the supply of fuel to said burner will be controlled by means operated by or under the control of the dynamo-circuit, so that as more or less current is called for the supply of fuel will be correspondingly varied. The means for thus varying the supply of fuel is automatic in its action and may consist of a solenoid or other electromagnetic device included in or operated by the dynamo-circuit and having its armature connected with a valve which is adapted to control the supply of fuel to the burner. The means provided for connecting the armature of the solenoid with the controlling-valve preferably comprehends an automatic device by which said valve will be positively closed whenever the armature of the solenoid returns to its normal or retracted position, thereby shutting off the supply of fuel; yet means is also provided whereby said automatic device may be prevented from thus operating at the will of the operator. Means is also provided for operating said valve independently of the automatic means in order that said valve may be opened a limited distance whenever desired—as, for instance, when starting the apparatus—and said independent means for operating said valve is preferably employed as the means for placing said valve under the control of the automatic operating device. By providing means for thus varying the output of the power generating and converting apparatus which is operated or controlled by the dynamo-circuit the speed of the armature of the dynamo may be maintained substantially constant under varying loads.

Figure 1 shows in side elevation and diagram an electric generating apparatus embodying this invention; Fig. 2, a diagram showing the dynamo and its circuit and the automatic device controlled by said circuit for varying the output of the motor; Figs. 3 and 4, details to be referred to.

a represents a steam-generator, which may be a boiler of any ordinary type, and said steam-generator is provided with a burner of any suitable description, which is supplied with fuel, preferably in the form of a gas, by means of a pipe *a'*.

b represents an engine of any ordinary type, and in conjunction with the steam-generator constitutes a power generating and converting apparatus. *c* represents a dynamo, also of any ordinary type, although a compound-wound dynamo appears to be best suited for practically carrying out this invention, and consequently such form is herein shown.

The steam-generator and engine serve as a power generating and converting apparatus for operating the dynamo, and they are herein shown merely for the sake of illustrating

my invention, as I do not desire to limit my invention to the employment of such form of power generating and converting apparatus.

A delivery-pipe a' is connected with the conducting-pipe a^2, which is connected with any suitable supply of fuel, although for the purpose of this invention the fuel which passes through or along the conducting-pipe a^2 is in the form of a gas. The pipe a^2 may be connected directly with a gas-supply or with a supply of any kind of liquid hydrocarbon, as preferred; but if connected with a supply of liquid hydrocarbon means will be provided for vaporizing the said liquid hydrocarbon before or as it enters the pipe a^2.

A valve e is provided which controls the supply of fuel to the burner, and said valve e is herein represented as comprising, essentially, a valve-case e', to which the pipes a' and a^2 are connected, and a valve-plug e^2, contained therein, which is adapted to close upon a seat e^3. The valve-plug e^2 is formed or provided with the screw-threaded stem e^4, working in a suitable stuffing-box or packing, so that by turning said stem the valve-plug e^2 will be moved toward and from its seat. Whenever the valve e is open and the burner lighted, an energizing agent will be developed by heat and the steam-generator will be operated and also the engine and dynamo. The present invention, however, comprehends suitable means by which the valve e may be opened more or less to supply a varying quantity of fuel to in turn vary the quantity of steam in the boiler in order that the output of the dynamo may be accordingly varied to compensate for the number of lamps or other translating devices which are included in or operated by the dynamo-circuit—as, for instance, if but a few lamps are turned on the valve e will be opened but little, whereas if a greater number of lamps are turned on the valve e will be opened wider. In carrying out this result means is provided for operating said valve e automatically which will be controlled by or will be under the control of the dynamo-circuit, so that as more or less current is called for the valve e will be opened more or less. Many forms of automatic devices may be provided for accomplishing this result, one of which is herein shown for the sake of illustrating the invention. The form herein shown consists of a solenoid f included in the circuit f' of the dynamo c, to be operated thereby, it being shown as included in series in said circuit, and the lamps f^2 may be arranged in parallel in said circuit as usual, and as said lamps are connected with the circuit f', or, in other words, turned on, the armature f^3 of said solenoid will be attracted more or less, according to the number of lamps which are connected in circuit. The greater the number of lamps which are connected in circuit the more said armature f^3 will be attracted. The armature f^3 has projecting from it an arm f^4, which has attached to or connected with it a rack-bar f^5, and as the armature is moved in either direction the rack-bar f^5 will be correspondingly moved. A spiral spring f^6 is provided for positively returning the armature to its normal retracted position, and a dash-pot f^7 or any other suitable retarding device will be provided to regulate the return of said armature. The rack-bar f^5 is adapted to engage a pinion f^8, which is secured to the valve-stem e^4, so that as said rack-bar is moved in either direction the valve-stem will be correspondingly turned to move the valve-plug e^2 toward and from its seat. With the parts so far described it will be seen that as the lamps are connected in circuit or turned on the armature of the solenoid will operate the valve e more or less, according to the number of lamps thus connected in circuit or turned on, and consequently as more or less current is called for the steam-generator will be correspondingly supplied with a greater or less quantity of fuel. Thus it will be observed that the valve e is operated automatically by means controlled by or under the control of the dynamo-circuit.

When starting the apparatus—as, for instance, when lighting the burner of the steam-generator—it is necessary to first open the valve e, and means is herein provided for accomplishing this result by hand which is independent of the automatic means provided for operating said valve. Also when all the lamps have been turned off or disconnected from the circuit it is desirable to close the valve e automatically. As a simple way of accomplishing these two results a hand-lever h is secured to the valve-stem e^4, which may be raised from the position shown in Fig. 3 to the position shown in Fig. 4, and when thus raised the valve-stem e^4 will be turned sufficiently to open the valve e a little way, so that a limited supply of fuel is provided, and a latch h' is provided which engages the hand-lever h and holds it in such position while the steam is being generated in the boiler. The hand-lever will remain in this position until the electric current traverses the circuit—as, for instance, until the lamps are turned on—and then as the armature f^3 attracts the rack-bar will serve as an operating device for said valve-stem e^4 and will move the hand-lever farther in the same direction that it was moved to open the valve in starting the apparatus. Thus it will be seen that the valve e is adapted to be operated independently of the automatic means provided for operating it to open the valve a limited distance when starting the apparatus.

The pinion f^8 is made as a mutilated pinion—*i. e.*, several of its teeth are removed—so that as the valve-stem e^4 is turned by the hand-lever h to open the valve e the rack-bar will not be moved; but just as said hand-lever becomes engaged by the latch h^5 the first tooth of said pinion is brought into engagement with the teeth of the rack-bar, so that said rack-bar may serve to further turn the pinion and operate the valve e. Hence it

will be seen that the automatic means employed for operating the valve *e* will be brought into action by the means employed for independently moving the valve-stem to open the valve. As the lamps are turned off and the rack-bar f^5 returns to its normal position, as represented in Fig. 4, the hand-lever will be returned until it is brought into engagement with the latch *h'* unless means are provided for obviating such result.

In some instances it will be found desirable to keep the valve *e* open at all times, so that the lamps may be turned on at any time without necessitating relighting the burner, and in such case the latch *h* will serve to keep the valve *e* open a limited distance even when all the lamps are turned off and the armature of the solenoid has returned to its normal retracted position. In other instances it will be found desirable to positively close the valve *e* whenever all the lamps are turned off, and in order that this result may be accomplished automatic means are provided for removing the latch from its engaging position, and for simplicity I have provided on said rack-bar a pin 2 and have provided the latch *h'* with a short arm 3, which projects into the path of movement of said pin 2, and as the rack-bar descends or is moved by the attraction of the armature f^3 the pin 2 will engage said short arm 3 and lift the latch *h'*, so that upon the return of said rack-bar to its normal position the latch *h'* will not be in position to engage the hand-lever. The latch when thus operated will be reset by hand. A friction-plate is provided at the pivot of the latch which is capable of holding said latch in whatever position it may be set. The hand-lever will be weighted sufficiently so that it will fall by gravity at such time and turn the valve-stem e^4, and thus automatically close the valve *e*. I do not, however, desire to limit my invention to including this feature, as it may or may not be employed.

The dynamo-circuit *f'* will be provided with any suitable form of main switch *i* by which it may be opened and closed.

I do not desire to limit my invention to the employment of any particular form or construction of means for automatically operating the valve *e* which is controlled by the circuit of the dynamo, as it is obvious that many different devices may be employed, all of which I intend shall come within the spirit and scope of this invention.

I claim—

1. An electric generating apparatus comprising a power generating and converting apparatus, the energizing agent of which is developed by heat, a dynamo, and a controlling device operated by the circuit of said dynamo for varying the supply of energizing agent to said generating and converting apparatus, whereby the output of said generating and converting apparatus may be varied to compensate for variations in the output of the dynamo, substantially as described.

2. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator and means for controlling the supply of fuel to said burner which is operated by the circuit of said dynamo, substantially as described.

3. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator and automatic means for controlling the supply of fuel to said burner which is controlled by the circuit of said dynamo, substantially as described.

4. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve for controlling the supply of fuel to said burner and means for operating said valve operated by the circuit of said dynamo, substantially as described.

5. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve for controlling the supply of fuel to said burner, an electromagnetic device operated by the circuit of said dynamo, the armature of which is connected with and adapted to operate said valve, substantially as described.

6. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve controlling the supply of fuel to said burner and automatic means for operating said valve operated by the circuit of said dynamo and means for operating said valve independently of said automatic means, substantially as described.

7. In an electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve controlling the supply of fuel to said burner and automatic means for operating said valve operated by the circuit of said dynamo and means for operating said valve independently of said automatic means, which also serves as and constitutes means for throwing said aumatic means into action, substantially as described.

8. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve controlling the supply of fuel to said burner, automatic means for operating said valve operated by the circuit of said dynamo and means for opening said valve independently of said automatic means which is in turn operated automatically to close said valve, substantially as described.

9. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve controlling the supply of fuel to said burner, automatic means for operating said valve

operated by the circuit of said dynamo and means for opening said valve independently of said automatic means which serves as a means for throwing said automatic means into action and which is in turn operated by said automatic means to close said valve, substantially as described.

10. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve for controlling the supply of fuel to said burner, an electromagnetic device operated by the circuit of said dynamo and means for connecting the armature of said electromagnetic device with said valve whereby said valve will be operated by said electromagnetic device, substantially as described.

11. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve for controlling the supply of fuel to said burner, an electromagnetic device operated by the circuit of said dynamo and means for operating said valve and for also connecting the armature of said electromagnetic device with said valve, substantially as described.

12. An electric generating apparatus comprising a steam-generator, engine and dynamo, a burner for said steam-generator, a valve for controlling the supply of fuel to said burner, an electric magnetic device operated by the circuit of said dynamo and means for connecting the armature of said electromagnetic device with said valve whereby said valve will be operated by said electromagnetic device, said means comprehending an automatic device for closing said valve when the armature returns to its retracted 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:

FORREST L. EVANS,

ARTHUR A. AVERILLE.