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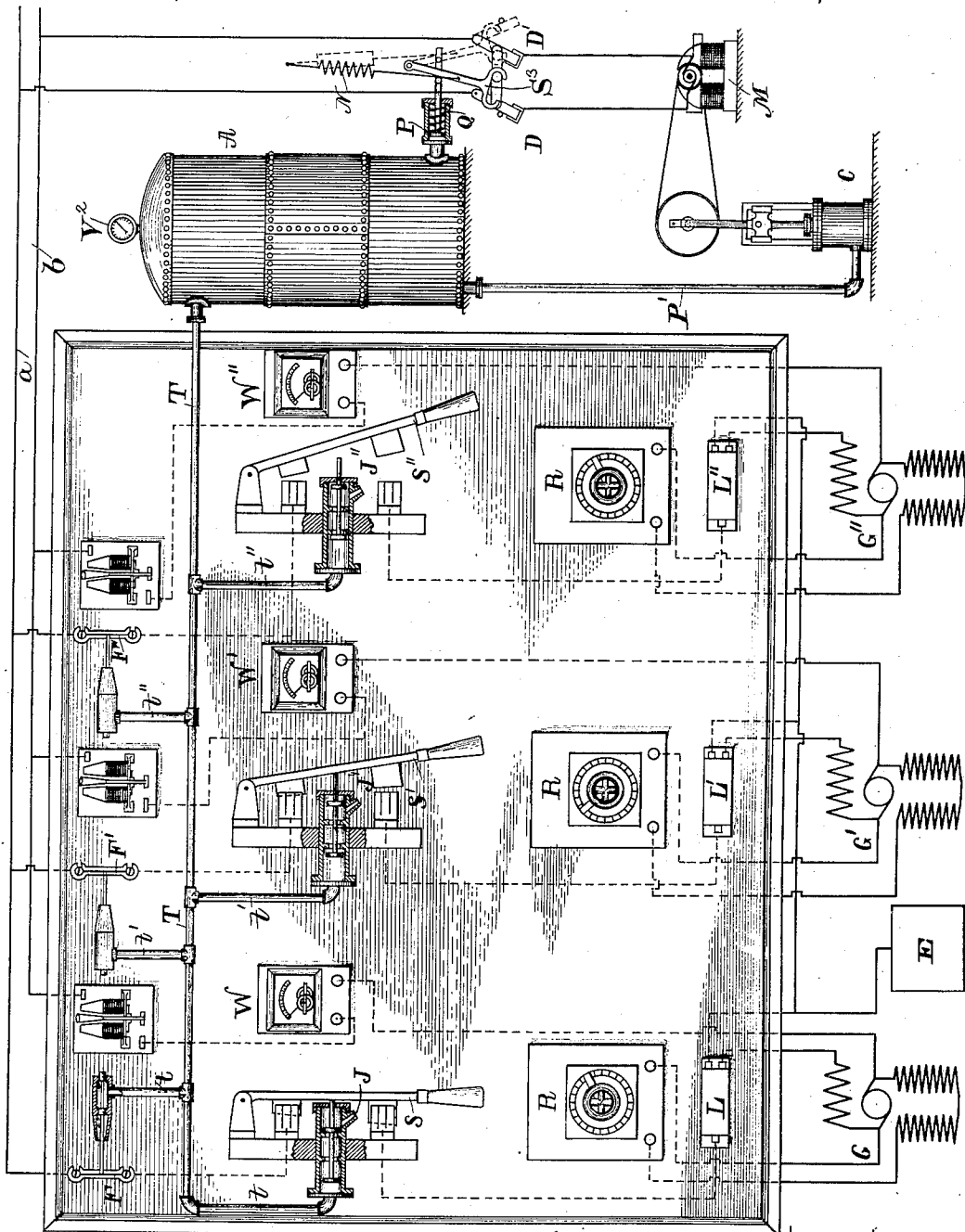
3 Sheets—Sheet 1.

E. THOMSON.

MEANS FOR PREVENTING ARCING IN ELECTRIC POWER STATIONS.

No. 520,809.

Patented June 5, 1894.



WITNESSES.

A. F. Macdonald.
John H. Litchney

[91-]

INVENTOR.

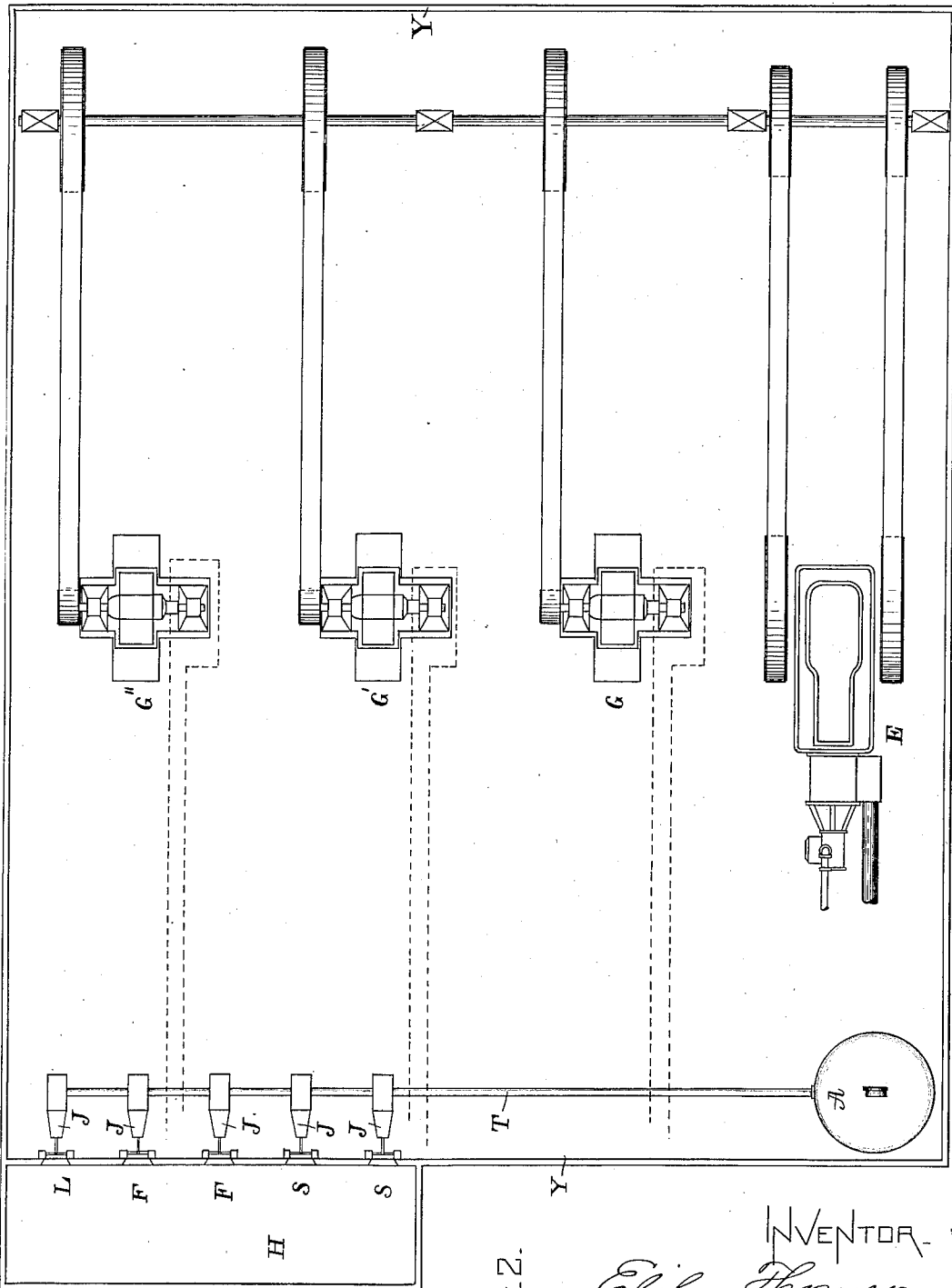
Elim Thomson
by Bentley Knight
Atty.

E. THOMSON.

MEANS FOR PREVENTING ARCING IN ELECTRIC POWER STATIONS.

No. 520,809.

Patented June 5, 1894.



WITNESSES.
W. F. Macdonald,
John W. Libboney

Fig. 2.

INVENTOR—
Elihu Thomson
 by *Burley Knight*
Atty.

(No Model.)

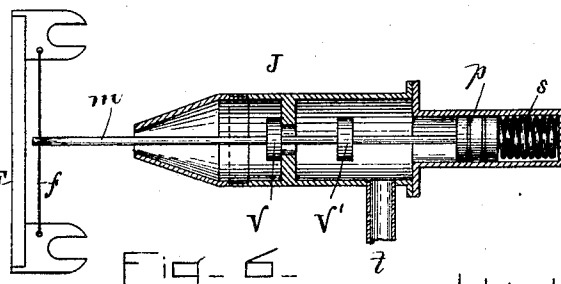
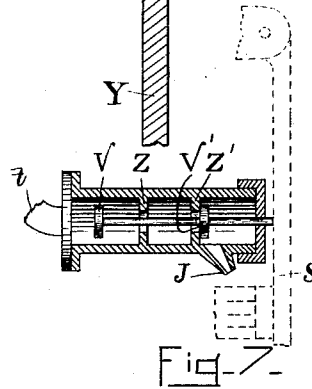
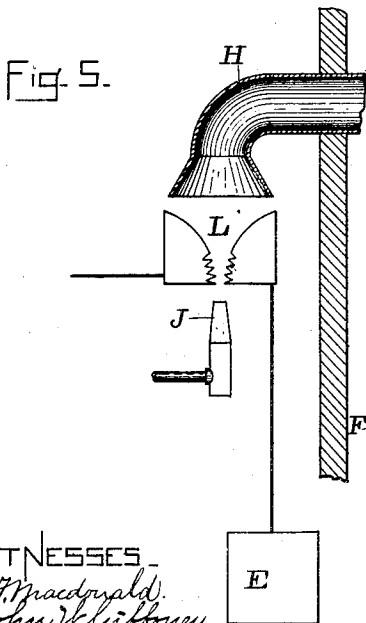
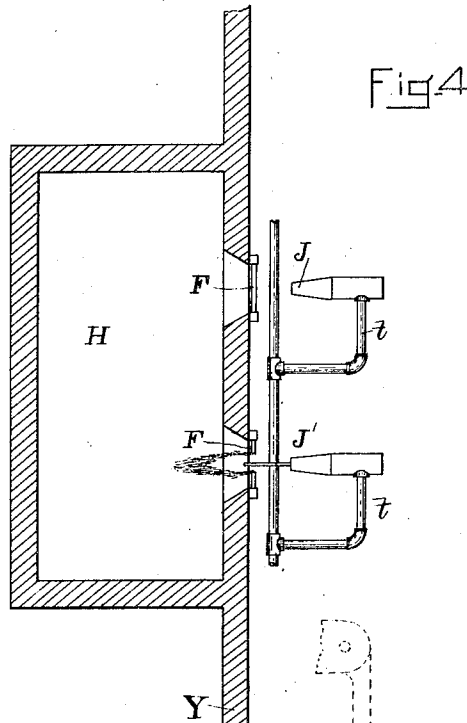
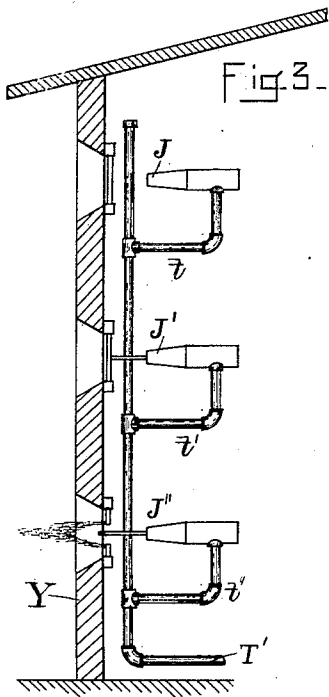
3 Sheets—Sheet 3.

E. THOMSON.

MEANS FOR PREVENTING ARCING IN ELECTRIC POWER STATIONS.

No. 520,809.

Patented June 5, 1894.



WITNESSES
W. Macdonald
John H. Gibbons

INVENTOR
Elihu Thomson
 by *J. M. Wright*
Attys.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

MEANS FOR PREVENTING ARCING IN ELECTRIC-POWER STATIONS.

SPECIFICATION forming part of Letters Patent No. 520,809, dated June 5, 1894.

Application filed September 1, 1890. Serial No. 363,879. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented a certain new and useful improvement in Means for Preventing Arcing in Electric-Power Stations, of which the following is a specification.

My invention comprises certain improvements designed to be used in connection with electric power installations in which are employed currents of electricity of great volume and considerable potential, such as will maintain arcs across spaces which are separated by only a small interval. It is based upon and may be considered as an extension of Letters Patent No. 265,936, granted to me October 10, 1883, in which a jet of air is forced between the discharge terminals upon the interruption of the electric circuit. My present invention however, goes farther and comprises a distribution system for distributing air or other insulating fluid to the various circuit breaking apparatus found in power stations, such as fuses, lightning arresters, and switches, to the end that the air jet may disrupt any arc which may form thereat, and the pipes leading from the air reservoir to the circuit breaking apparatus are provided with valves so arranged that the jet of air may be delivered upon the arcs at the moment the circuit is ruptured. Thus the safety fuse may be made to control a valve in such manner that on blowing or melting the stream of air will be turned on and extinguish any arc at that point, and also the switches when thrown to open the line circuit may be made to automatically open valves whereby the jet of air will be thrown between the switch contacts.

My present invention also provides means for getting rid of the fumes or gases arising from the arcs, and to that end I provide a separate fume chamber distinct from the station proper, so placed as to receive the jets of air after they have been forced through the arcing spaces.

My invention also comprises other features of construction as will be seen from the following description and claims.

In the accompanying drawings Figure 1

shows a station switch board having my improvements applied thereto. Fig. 2 shows a plan of an electric power station with certain of the devices therein used. Fig. 3 is an enlarged view of an arrangement of fuses after the manner of my invention. Fig. 4 illustrates the fume chamber in section. Fig. 5 illustrates a lightning arrester arranged in accordance with my invention. Fig. 6 is a sectional view of the valve chamber and valves showing also a preferred form of fuse for use in connection therewith. Fig. 7 is an enlarged view of a modified form of device such as generally will be used with switches and similar apparatus.

In Fig. 1, G, G', G'', are electric generators one or a number suitably located in a station or power house and coupled up to form a multiple-arc or series system or a combination of the two, the first being the one herein shown. The generators are connected to the external or line circuits on one side through lightning arresters L, L', L'', switches S, S', S'', fuses F, F', F'', to the line *a*, and from the other side to the other line *b* and other station apparatus illustrated conventionally at W, W', which is employed in electric distribution systems. From the lightning arresters L, L', L'', a connection to earth E is made in the usual manner to conduct away from the machines static discharges coming in from the lines.

In order to avoid arcing at the various circuit breaking apparatus described which is used in such an installation, I provide an air distribution system (though other insulating fluids might be used with the same results) which distributes air to the different circuit breaking apparatus so that upon the interruption of the circuit at any one the air jet will be present to extinguish any arcs formed thereat. At the right will be seen an air pump C, driven by an electric motor M, and connected by pipe P' to the reservoir A, in which the air is compressed, the pressure being indicated by a gage V² in the usual manner. From the reservoir is led a distributing system of pipes or other ducts which are shown as consisting of a main tube T, T, and branch tubes *t*, *t'*, *t''*, extending to the circuit interrupting devices hereinbefore mentioned.

At each switch or fuse the discharge pipe is preferably provided with a valve chamber, and valves which are normally held closed but are automatically opened upon the breaking of the circuit, so that the jet of air may be discharged across the space where the arc is formed. To this end I provide at the switches some such arrangement as is illustrated in Fig. 7, where t represents the discharge tube, S the switch, and J the nozzle opening from the valve chamber and pointing toward the switch terminals. Without the valve chamber are two partitions Z, Z' , having central openings which are closed alternately by the valves V, V' , the arrangement being such that the valve V' is opened when the switch is thrown as shown at S' , Fig. 1, and after a predetermined interval which may be regulated by a dash pot the pipe is again closed as at S'' by valve V .

In Fig. 6 another preferred arrangement of valves is illustrated, and also a fuse for use therewith. The latter consists of two portions, a main fuse wire F , easily melted by an excessive current, and an auxiliary wire f which is small and of metal, such as steel, iron, German silver, &c., having great tensional strength as compared with the wire F . The valve V is normally held closed against the air pressure and the tension of spring s , which bears against the plunger head p , by the stem m which rests against wire f . When the main fuse wire F is melted the current is diverted to the wire f which is instantly consumed. The valve V is automatically opened and the air blows out any arc which may have formed between the terminals. To prolong the action of the air jet and so insure the extinguishing of the arc the movement of the valve is retarded by the head p , which allows air to pass slowly into the space occupied by the spring s , thus acting as a dash pot.

Fig. 5 illustrates a simple arrangement for a lightning arrester used with the air supply system herein described. The chimney H is placed in front of the arrester plates and may lead to the external air or a specially constructed fume vault. A static discharge readily leaps the gap separating the arrester plates but the formation of an arc is prevented because the normal line potential is incapable of sustaining such an arc against the disruptive action of the air jet which is continually being driven across the sparking gap.

I prefer to keep a constant pressure in the reservoir A , and to this end I provide an automatic starting and stopping mechanism for the motor M , driving the pump C . Connected to the boiler A is a valve or piston P , the head of which is held against the air pressure by a spring Q , and the stem extends outward engaging with the pivoted switch S^3 , so that the outward movement of the rod opens the switch contacts at D, D' . Hence when the air pressure has reached a predetermined amount the motor M is stopped, and when the air pressure has fallen so that the spring Q

forces the piston back against it, the switch S is again closed to put current on the motor and operate the pump. The switch S is also provided with a spring N tending to hold it in its extreme open or closed position, and to snap it to either side of a dead center. In this way the switch is not affected by the slight fluctuations of the piston P and the motor M is positively started and stopped, whereas if some such device was not used there would tend to be a continuous making and breaking of contact at the switch accompanied with sparking.

In Fig. 2 a plan of a station fitted with my improvements is shown. Y, Y , are the walls of the station proper, and H indicates a small fume chamber or vault adjacent thereto to receive the metallic vapors arising from the arcs and blown fuses. Between the interior of the station and the vault there are openings in the wall Y , at the points where the various circuit breaking apparatus is located to which the air jet is applied. G, G', G'' , are the electric generators from which are led to the switch board the usual connections as indicated in dotted lines. A is the reservoir for the compressed air and the pipe T distributes it to the circuit breaking apparatus in use.

In Fig. 3 it is shown that the openings in the wall Y instead of leading into a vault H as in Fig. 2 may open to the exterior of the station, but this arrangement is not so desirable. It will of course be understood that the specific apparatus described may be varied within wide limits without departing from my broad invention.

By controlling the air supply as above described from the general electric circuit, as through the electro-magnetic motor, an automatic adaptation of the air pressure to the needs of the system is secured, as the air-supplying devices are stopped or started simultaneously with the generating apparatus or are dependent on the electrical condition of the system.

I claim—

1. The combination in an electric power installation of the various circuit breaking apparatus as described, used in connection therewith, with an air or other insulating fluid distribution system, arranged to deliver a jet of air or like fluid across the arcing space at any desired or necessary one of the said circuit-breaking apparatus, and an electro-magnetic device connected with the general electric circuit of the installation and a controlling means for supplying the insulating fluid and itself controlled by devices operated by the pressure in the air system, as and for the purposes set forth.

2. The combination in an electric power installation, of the various circuit breaking apparatus as described used in connection therewith, with an air or other insulating fluid distribution system arranged to deliver a jet of air or like fluid across the arcing space at any desired or necessary one of the said cir-

cuit breaking apparatus, a pump for said distribution system, an electro-magnetic device connected with the general electric circuit of the installation and controlling the pump and itself controlled by devices operated by the pressure in the air system.

3. The combination with a reservoir, and an insulating-fluid distributing system leading to the various circuit breaking apparatus of an electric power installation, and designed to prevent arcing thereat by delivering a jet of air or like fluid across the arcing space, of a compressor forcing air into the reservoir, and a pressure valve connected with the reservoir and controlling the compressor.

4. The combination with a reservoir, and an insulating fluid distributing system leading to the various circuit breaking apparatus of an electric power installation and designed to prevent arcing thereat by delivering a jet of air or like fluid across the arcing space, of a compressor forcing air into the reservoir and driven by an electric motor, a controller for the said motor, and a pressure valve connected with the reservoir and actuating the controller.

5. The combination with an air reservoir, and a distribution system for distributing jets of air to the various circuit breaking apparatus of an electric power installation, of a pump for forcing air into said reservoir, an electric motor driving the pump, a switch in the motor circuit, a spring holding the same on either side of a dead center, and a device actuated by the air pressure in the reservoir connected to and automatically operating said switch as set forth.

6. The combination in an electric power installation, of a circuit breaker, with a discharge pipe through which air or other insulating fluid is delivered to disrupt any arcs forming at the circuit breaker, and a valve held by the circuit breaker in the position closing the pipe when the circuit is closed, but freed when the circuit is broken.

7. The combination with an electric circuit breaker and a discharge pipe through which

air or other insulating fluid is delivered to prevent arcing at the circuit breaker, of a self-closing valve in the pipe held closed by the circuit breaker when the circuit is closed, but freed so as to temporarily open the valve when the circuit is broken, as described.

8. The combination with a fuse included in an electric circuit, of a discharge pipe for directing a blast of air across the arcing space formed by the blowing of the fuse, a valve in said pipe held under tension in a closed position by said fuse, and automatically opened upon the rupture of the fuse as set forth.

9. The combination with a fuse included in an electric circuit and provided with main and auxiliary fuse wires, of the pipe for discharging a jet of air across the arcing space formed when the fuse is blown, and the valve held under tension in a closed position by said auxiliary wire as described.

10. The combination with a circuit breaker in an electric power installation, and a discharge pipe through which air or other insulating fluid is forced to prevent arcing at the circuit breaker, of the valve automatically opened upon the breaking of the circuit, the spring for closing the valve, and a dash pot for regulating the duration of the air blast as described.

11. The combination with a circuit breaking apparatus of a wall or partition on one side of said apparatus and provided with an opening in proximity thereto, and an air or equivalent blast apparatus for propelling toward said opening any arc which may form at said circuit breaking apparatus.

12. The combination with a circuit breaking apparatus of a wall or partition on one side thereof, and provided with an opening in proximity thereto, and arc propelling means for forcing toward said opening any arc that may form at said circuit breaking apparatus.

ELIHU THOMSON.

Witnesses:

JOHN W. GIBBONEY,
ROBERT SHAND.