(No Model.) 2 Sheets—Sheet 1.

T. A. EDISON.

VALVE GEAR.

No. 365,465. Patented June 28, 1887.

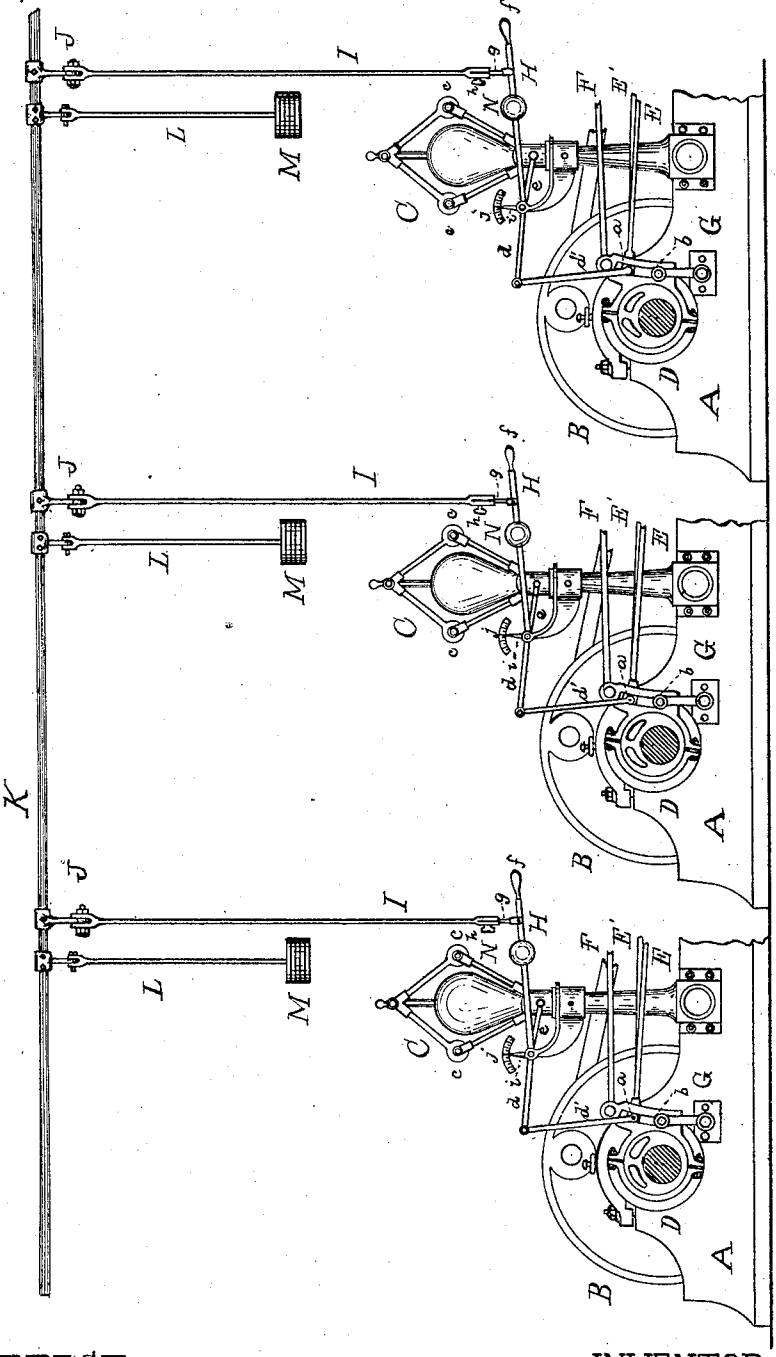

Fig. 1.

ATTEST:
Edw. C. Rowland
H. W. Seely

INVENTOR
Thomas A. Edison
By Richd. N. Dyer
Atty.

(No Model.) 2 Sheets—Sheet 2.

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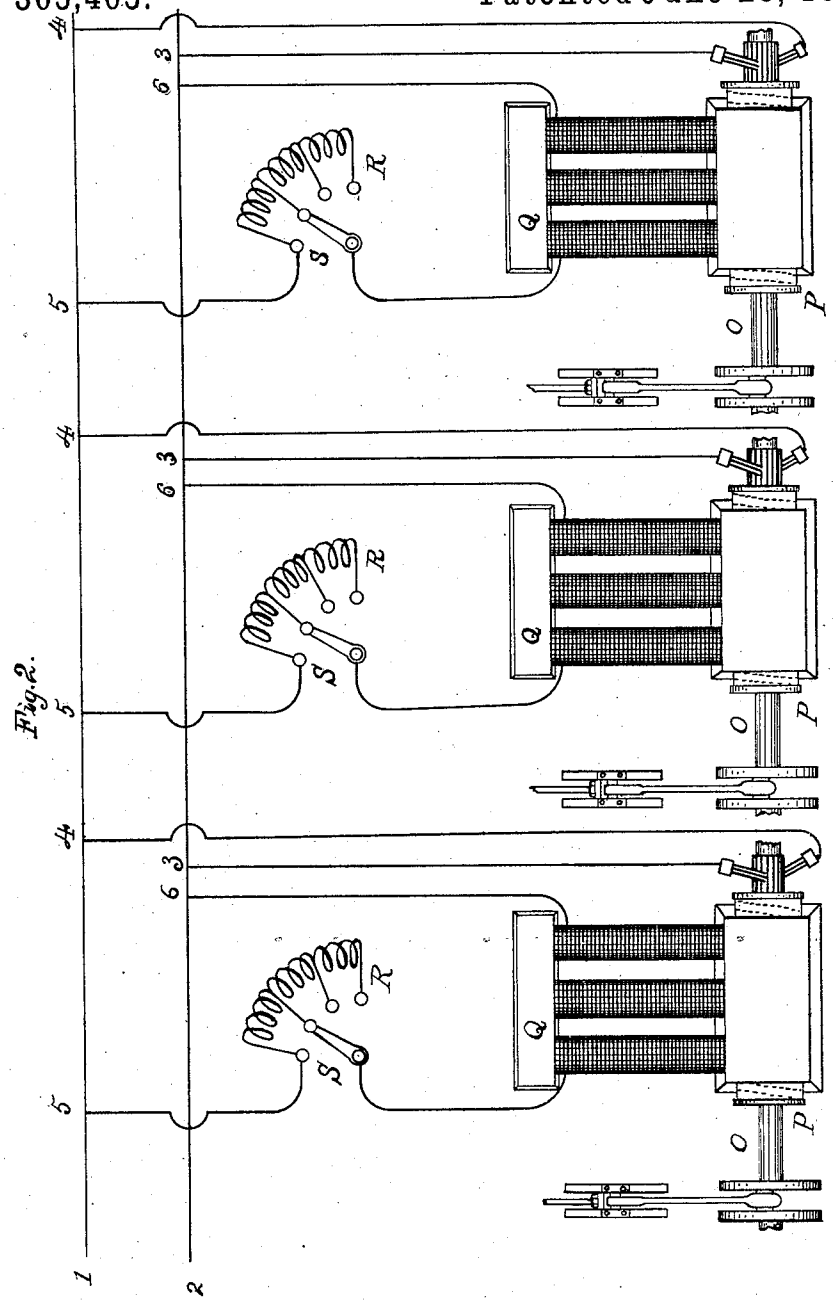

Fig. 2.

ATTEST

E. C. Rowland,

N. W. Seely

INVENTOR:

Thomas A. Edison,

By Rich^d N. Dyer

Atty.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY, ASSIGNOR TO THE EDISON ELECTRIC LIGHT COMPANY, OF NEW YORK, N. Y.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 365,465, dated June 28, 1887.

Application filed October 12, 1882. Serial No. 74,096. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented a new and useful Improvement in Valve-Gear for Electrical-Generator Engines, (Case No. 488,) of which the following is a specification.

In my system of electrical distribution the dynamo-electric machines which supply current to the translating devices of a district are placed in multiple-arc relation to each other at a central station, each machine being run preferably by a separate steam-engine and the armatures being revolved directly by the engine-shafts, without the interposition of belts or other gearing, when high-speed engines are used; but with slow-speed engines suitable belts or gearing, or both, are used to multiply the speed.

In operating a number of dynamo or magneto electric machines arranged in multiple-arc relation to each other it is necessary that the machines should all produce the same electro-motive force; and in order that they should do this it is necessary that their armatures should all be revolved at the same or practically the same speed. In a multiple-arc arrangement of electrical generators operated by separate steam-engines, the governors of the independent engines having independent movements, or vibrating or jumping to a greater or less extent, the generators must necessarily vary in speed and electro-motive force. This variation in speed and electro-motive force results in an action peculiar to the multiple-arc arrangement of the generators, generators having lower speed and electro-motive force being driven as motors by the current from other generators, and this relation being reversed at intervals by the racing of the engines; hence it is generally impossible to operate generators in multiple arc by means of separate independent steam-engines.

The object of this invention is to do away with any difficulty of this kind. I prefer to accomplish this by so connecting the throttle-valve or cut-off mechanisms of all the engines that any variations in the action of such mechanism, produced either by the governor or by hand on one engine, are communicated to all the others, so that if the admission of steam to the chest or cylinder of one engine is varied the same variation is produced in all the other engines of the system. The engines which it is preferred to use are those in which the steam is cut off from the cylinder during a portion of each stroke of the piston, and the time of so cutting off the steam is regulated by a centrifugal or other form of governor; but the invention is equally applicable to engines in which the admission of steam is controlled entirely at the throttle-valve.

In carrying out my invention one or more lines of connected shafting are provided, to which a number of arms are attached, each running to one of the engines and there adjustably and removably connected with the throttle-valve or cut-off mechanism in such manner that a variation in the position of such mechanism on one engine is communicated through said arm to the shaft and thence to the throttle-valve or cut-off mechanism of all the other engines connected with said shaft.

The variation of the valve or cut-off mechanism may be accomplished solely and automatically by the governors of the engines, or means may be employed at each engine operated by hand for varying the cut-off. Such means may be employed in connection with the governor, or the governor may be used simply as an indicator of speed and the regulation effected solely by hand, a suitable indicating device being employed in connection with the governor, if desired, or the governor may be dispensed with altogether and the regulation accomplished only by hand.

When the speed is regulated by hand, the connecting shafting may be moved directly by a hand-lever, and all the throttle or cut-off mechanisms adjusted simultaneously, or the connection with such shafting at any engine may be moved, moving the shafting and the connection of all the other engines.

Suitable friction devices, with or without counterbalancing-weights or any positive locking device, with or without friction devices or counterbalancing-weights, are used to hold the shafting in any position to which it is moved.

The connection of each engine with the

shafting is made removable, so that any engine can be disconnected therefrom or connected therewith at will. This connection is also made adjustable, in order that each engine can be adjusted to work in unison with the others. Instead of the arrangement described, the regulation may be accomplished automatically by the use of suitable electro-magnetic devices operated by the current generated; but this will form the subject of a separate application.

In the accompanying drawings, Figure 1 is a view in elevation of parts of three engines embodying my invention; and Fig. 2, a plan view and partial diagram representing parts of the engines, the generators driven thereby, and the electrical connections.

A A represent the bed-plates, B B the fly-wheels, and C C the centrifugal governors, of the engines.

D D are the eccentrics which operate the inlet-valves of the cylinder through rods E E′, and the exhaust-valves through rods F. (Such valves not being shown.) The rods E E′ are connected to the slide-block *a* in the curved slot *b*, and the rod F directly to the eccentric, the eccentric being guided in its movement by the vibrating lever G.

As is well understood, the movement of the governor-balls *c c*, acting through arm *e* and links *d d′*, varies the position of the slide-block *a* in the slot *b*, and thus causes the slide-valves to cut off the steam more or less quickly, according to the rapidity of the revolution of said governor-balls.

As seen in Fig. 2, each engine-shaft O carries the rotating armature P of a dynamo-electric machine having field-magnets Q. These dynamo-electric machines are in multiple-arc relation to each other, each armature P being in a derived circuit, 3 4, from the main circuit 1 2, and the field-magnets Q of each machine being in a derived circuit, 5 6, from said main circuit. Each of the field-circuits 5 6 contains a resistance, R, made adjustable by means of arm S. The object of these adjustable resistances is to regulate the generation of current by the machine for changes in the number of translating devices in circuit in the district supplied by the machines.

To the link *d* of each engine is pivoted a lever, H, terminating in a handle, *f*. From such lever extends upwardly a rod, I. The upper end of rod I is attached to arm J, which extends downwardly and outwardly from the shaft K. It will be seen that the position of the slide-block *a* of an engine is changed by moving the lever H, while at the same time such movement of the lever H produces, through rod I and arm J, a turning of the shaft K, which moves all the other arms J, rods I, and levers H, thus changing the positions of the slide-blocks *a* of all the engines.

From the shaft K extend the arms L downwardly and in an outward direction opposite to that of the arms J. Each arm L carries a weight, M, and such weights assist in the turning of the shaft when an arm J is raised. A weight, N, is placed on each of the levers H to assist in bringing the lever down, and the weights M and N act together to assist in holding the shaft K in any position in which it may be placed; but, as stated, frictional or other suitable devices may be used for so holding the shaft.

A removable and adjustable connection is made, as stated, between each lever H and its rod I. A small rod, *g*, attached to arm H, fits in the end of rod I, and is clamped therein by screw *h*, so that by loosening said screw the connection between the arm H and rod I is severed, and the engine may either remain disconnected or the lever H may be adjusted and the connection again made, whereby each engine is made independently adjustable. This could of course be accomplished in many other ways.

A pointer, *i*, attached to the arm *e*, indicates on a scale, *j*, the extent to which the governor-balls are thrown out, and the lever H is moved in accordance with these indications.

A convenient mode of adjusting all the engines to the same speed is to fix, when all the engines are disconnected from the shafting, by marking the rod I, or by setting a suitable gage or indicator attached to said rod, the point to which the lever H is to be adjusted. When the first engine is connected and adjusted to this point and its cut-off also adjusted to the proper point, the shaft is turned to the proper position, and in connecting the other engines it is necessary only to adjust their rods *g* to the same points on the rods I, when it will be seen that all the cut-offs will be placed similarly to the first one, and all the engines will run at practically the same speed.

In the form of my invention shown in the drawings it will be seen that the cut-off mechanism is operated both by the movement of the governor and by that of the lever H; but it is evident that the arm *e* need not be connected with the link *d*, but only with the pointer *i*, so that the regulation will be accomplished only by the arm H; or the governor might be dispensed with altogether and a speed-indicator provided elsewhere on the engine; or the governor could be used without the indicator and the speed of the engine noted merely by the eye.

It is also evident that the lever H could be used to alter the position of a throttle-valve, either in connection with a governor or without such governor, all the levers being connected with the shaft K, as before described; or my invention can be employed with any of the cut-off or valve mechanisms now in use.

While, as stated, my invention is especially intended to be applied to multiple-arc arrangements of electrical generators, yet it is equally applicable when such generators are placed in series, all feeding into the same main conductors, for here the same difficulty exists; as, should one machine give a higher electro-motive force than another the

latter will be converted into a motor, and the same irregularities will occur as in the multiple-arc arrangement.

I may, if desired, place the armatures of several machines on the shaft of each engine, or by belts or other gearing connect several machines with each engine, all the machines feeding into the same main conductors, and the engines being regulated as just set forth.

It is evident that my invention is applicable to motors other than steam-engines—such as water-wheels, gas-engines, compressed-air engines, &c.—where two or more such motors are used, each operating one or more electrical generators, and all such generators feeding into the same main conductors.

What I claim is—

1. The combination, with two or more engines having centrifugal governors, of connections between such governors causing them to act in unison, substantially as set forth.

2. The combination, with two or more steam-engines, each operating one or more dynamo or magneto electric machines, all of such machines being connected with the same conductors or system of conductors, of a line or lines of connected shafting, and connections from said shafting to the throttle-valve or cut-off mechanism of each engine, whereby variations in such mechanism in one engine are transmitted to the corresponding mechanism of both or all the other engines, substantially as set forth.

3. The combination, with the throttle-valve or cut-off mechanisms of two or more engines and the line or lines of connected shafting, of removable and adjustable connections between them, substantially as set forth.

4. The combination of the valve or cut-off mechanisms of two or more engines, the line or lines of connected shafting, connections between such mechanisms and such shafting, and means for holding such shafting in any position to which it is moved, substantially as set forth.

5. The combination of two or more steam-engines, one or more dynamo or magneto electric machines driven by each of said engines, all such machines being connected in multiple arc, and means for regulating the speed of both or all said engines simultaneously, substantially as set forth.

This specification signed and witnessed this 5th day of October, 1882.

THOS. A. EDISON.

Witnesses:
H. W. SEELY,
E. H. PYATT.