H. HERTZBERG.

AUTOMATIC ELECTROMAGNETIC SPEED CONTROLLER.

APPLICATION FILED OCT. 17, 1907.

990,264.

Patented Apr. 25, 1911.

2 SHEETS—SHEET 1.

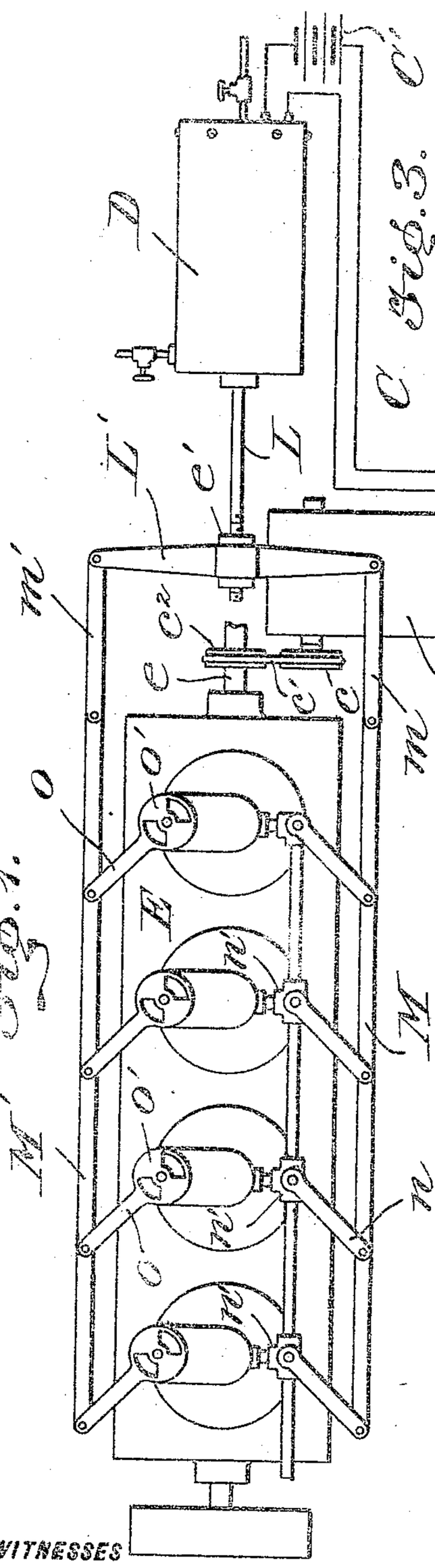

Fig. 1.

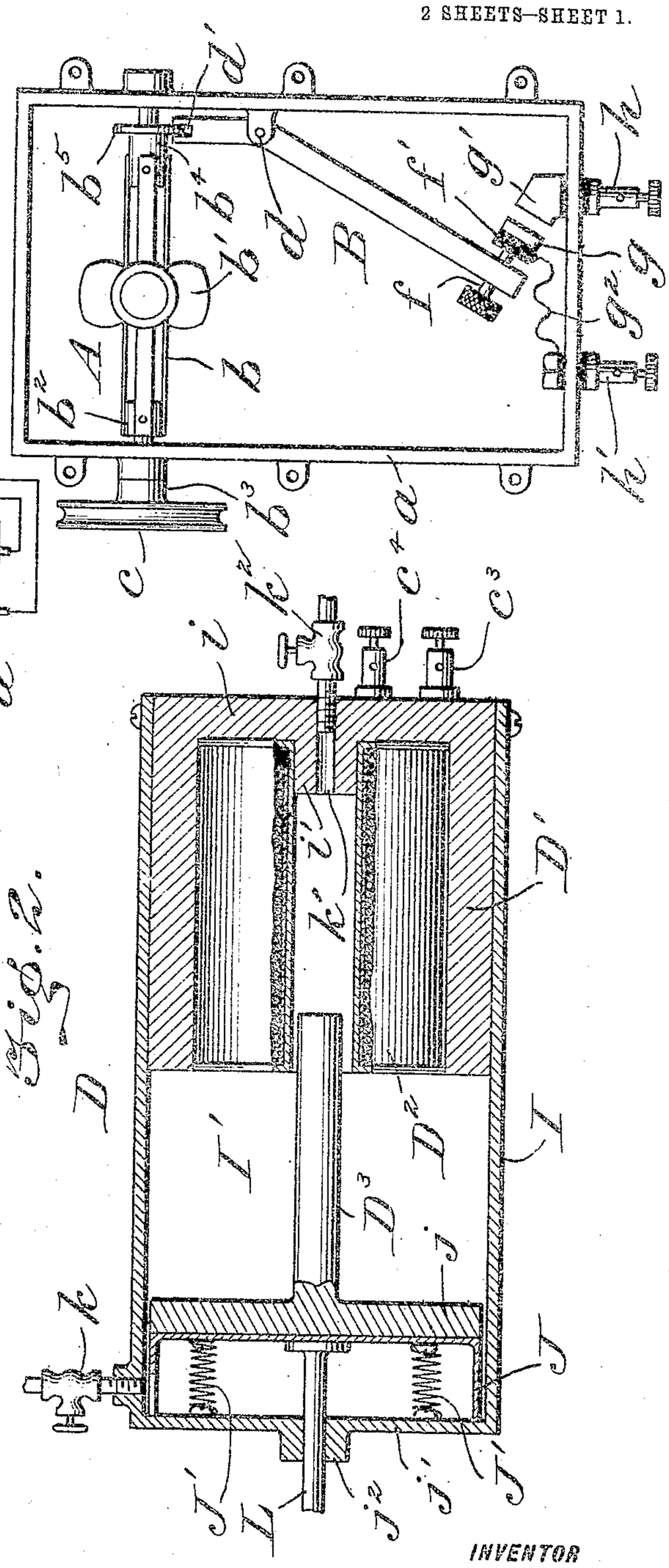

Fig. 3.

Fig. 2.

WITNESSES

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Fig. 5.

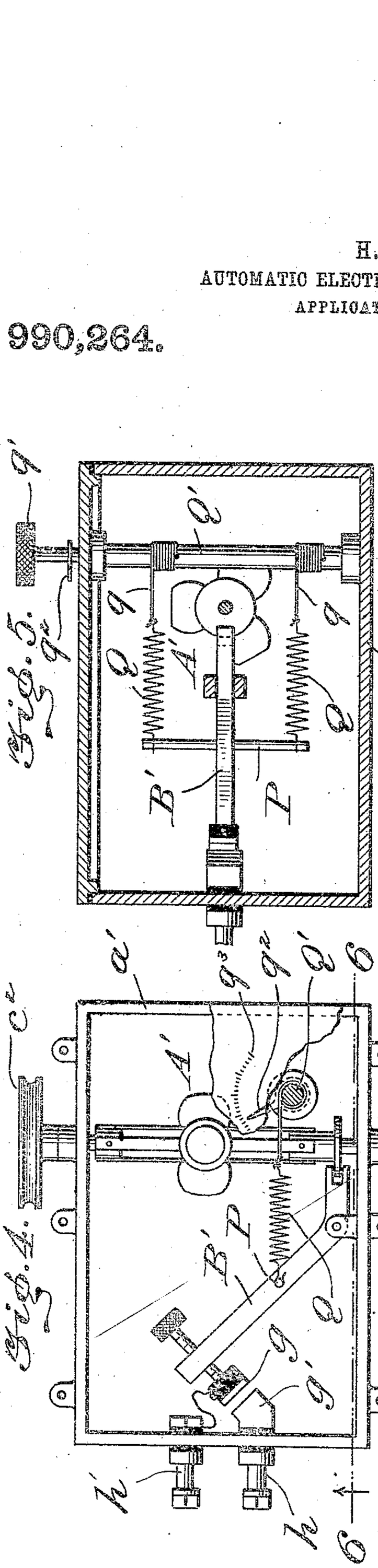
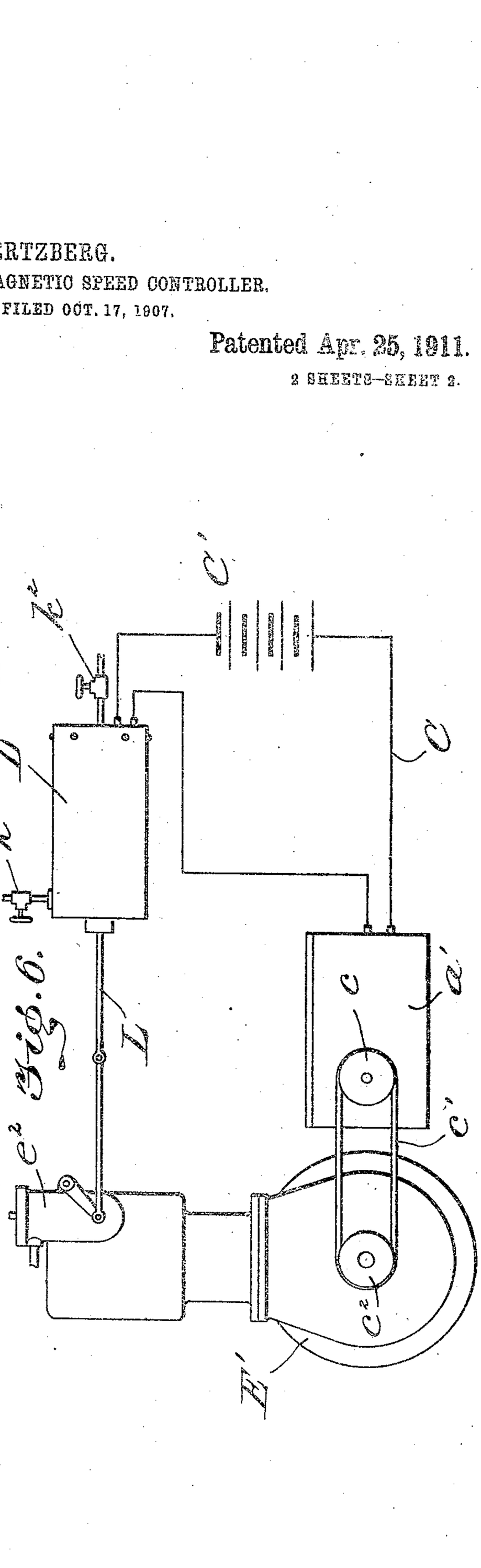


Fig. 4.

Fig. 6.



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AUTOMATIC ELECTROMAGNETIC SPEED-CONTROLLER.

990,264. Specification of Letters Patent. Patented Apr. 25, 1911.

Application filed October 17, 1907. Serial No. 397,911.

To all whom it may concern:

Be it known that I, HARRY HERTZBERG, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented a certain new and useful Automatic Electromagnetic Speed-Controller; of which the following is a specification.

This invention is a system for automatically controlling the speed of engines, such as internal combustion (explosive) engines, steam, air or gas engines, and, in fact, any type or class of engines, or other revolving mechanism.

The object in view is to automatically control the speed of an engine in case it runs too fast by partially closing the inlet or feed valve to said engine; and, furthermore, to check sudden or quick movement of the regulator for the purpose of giving a free easy movement to the device (such as an inlet or feed valve) to be acted on directly by the regulating mechanism.

The invention may be embodied in various forms of constructions, either mechanical or electrical, or partly mechanical and partly electrical.

One specific embodiment of the invention embraces a centrifugal governor operated by a rotary part of the engine to be controlled, said governor operating a circuit breaker, which controls an electro-magnet, whose plunger or armature operates the feed valve or valves of the engines, whereby in case of excessive speed the circuit breaker closes the circuit and the electro-magnet is energized for partially closing the engine feed valve.

An important element of the controller embraced in the system just mentioned is a novel form of electro-magnet, the plunger of which is associated with a dash pot, the inlet and egress of air to and from said dash pot being regulated by appropriate valves, whereby the plunger is restrained from sudden movement in either direction so as to secure steady and uniform operation of the engine valve.

In the accompanying drawings, I have illustrated different practical embodiments of the invention, but the construction shown therein is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a plan view showing the controlling mechanism in coöperative relation to an engine adapted to be driven by supplying kerosene and air to the cylinders thereof. Fig. 2 is a longitudinal section on an enlarged scale of the electro-magnet which operates the feed valve or valves of the engine. Fig. 3 is a detail view of a centrifugal governor and circuit breaker to be employed in the system of Fig. 1. Figs. 4 and 5 are detail views illustrating a novel form of tension device adapted for use in connection with the governor mechanism shown in detail in Fig. 3. Fig. 6 is a view illustrating the speed controlling mechanism in connection with an internal combustion engine of that type which is to be supplied with air and gasolene.

The controlling system shown in Figs. 1, 2, and 3 of the drawings, embodies a centrifugal governor, A, a circuit breaker, B, a circuit, C, and an electro-magnet, D, the detailed construction of which will now be set forth.

The governor, A, and the circuit breaker, B, are housed or inclosed within an appropriate casing, *a*, the latter being preferably water tight. Said governor is preferably of the spring and ball type, comprising the springs, *b*, having the weights, *b'*, each spring being fastened at one end to a collar, b^2, which is fast on a shaft, b^3, the other ends of said springs being attached to a slidable collar, b^4. The shaft, b^3, is provided with a pulley, *c*, adapted to be driven by a belt, *c'*, from a pulley, c^2, on a rotating part, such as the shaft, *e*, of the engine, E, the speed of which is to be controlled.

The circuit breaker is shown in Fig. 3 as embodied in an angular switch lever which is fulcrumed at *d* within the casing, *a*. One end of this switch lever is slotted or forked at

d' for engagement with the flange, b^5 of the head, b^4, constituting the movable member of the centrifugal governor, A. The long arm of the switch lever is provided with a set screw, f, the end portion of which is insulated at f', and is provided with a contact, g, the latter being insulated from the switch lever. Said contact, g, is adapted to engage with a fixed contact, g', which is insulated from the casing, a, and is connected electrically with a binding post, h. The movable contact, g, of the switch lever is connected by a wire or conductor, g^2, with another insulated binding post, h', and to the binding posts, h, h', are attached the wires forming the electric circuit, C, the latter being provided with a battery, C', or other source of electric energy.

The electro-magnet, D, shown more clearly in Fig. 2, consists of a mass of soft iron, D', a coil, D^2, and a plunger, D^3; and these parts are substantially inclosed within a casing, I, composed, preferably, of brass or other non-magnetic material. The metallic mass, D, is chambered for the reception of the coil, D^2, one end of said metallic mass being provided with an integral head, i, having an axial extension, i', that projects into one end portion of the coil, D^2. The plunger, D^3, is provided at one end with an integral head, j, said plunger and the head thereof being composed of soft iron. The plunger, D^3, operates within the coil in the usual manner, and said plunger with its head, j, are adapted to be attracted by the lines of force established in the mass of soft iron, D', and its extension, i', by a current which is admitted to the coil, D^2.

The casing, I, of the electro-magnet is fastened tightly to the magnetic mass, D', and said casing is provided at its other end with a head, j', the latter having an apertured boss, j^2. The casing, I, forms a dash pot chamber, I', at one end portion of the electro-magnet, D, and in said chamber, I', operates the head, j, of the plunger, D^3. To the head, j, is rigidly secured a piston, J, composed of brass or other non-magnetic material, and this piston is movable in the chamber, I', with the plunger, D^3. The plunger is adapted to be drawn in one direction by the magnetism established by the coil in the metallic mass, D', but the movement of the plunger, D^3, and the piston, J, in an opposite direction is brought about by mechanical means, such as the springs, J', which are housed in the hollow plunger, J, said springs being anchored by fastening them to the head, j', of the casing, I, and the other ends of said springs being attached to the hollow piston, J. The ingress and egress of air to and from the dash pot, I', is controlled by a valve, k, which is attached to the casing, I, and communicates with the dash pot chamber, I', near one end of the travel of the piston, J, in said chamber. As shown in Fig. 2, the extension, i', of the metallic mass, D', is provided with a passage, k', the flow of air through which is regulated by a valve, k^2. The valves, k, k^2, may be of any suitable type, but as shown, said valves are adapted to be adjusted by hand, in order to control the flow of air into or from the chamber, I' when the plunger, D^3, and the piston head, J, are moved within said chamber.

The electro-magnet is provided with suitable binding posts, c^3, c^4, to which are attached the conductors of the circuit, C, thus including the electro-magnet in circuit with the battery, C'.

When an electric current is admitted to a coil of a solenoid, the plunger of said solenoid is usually moved suddenly and quickly by the attraction of the magnetic mass, but the electro-magnet shown in Fig. 2 of the drawings, embodies a pneumatic check or dash pot which effectually precludes any sudden travel of the plunger. The movement of the plunger, D^3, into the coil of the solenoid is opposed in a measure by the pneumatic cushion which is produced by compressing air in the chamber, I', due to the movement of the head, j, toward the core, the air thus compressed flowing into the coil, D^2, and through the passage, k', and the valve, k^2, associated with the extension, i'. The compression of air within the chamber, I', forces the air slowly out of the valve, k^2, at one end of the electro-magnet, but at this time air is admitted by the valve, k, back of the piston, J. When the plunger is released by breaking the circuit, C, the springs, J', pull the piston and the plunger in an opposite direction, and at this time the air is compressed between the head, j, and the piston, J, so as to check the movement of the plunger in the opposite direction. In the practical operation of the regulator system it will be found that the plunger, D^3, and the piston, J, will move intermittently and the dash pot is normally in use for checking the sudden movement of the plunger.

The movement of the plunger operates the inlet valve of the engine, E, which is to be controlled, but, in Fig. 1, I have illustrated means for operating both the fuel valves and the air valves which are associated with a plurality of piston cylinders, the latter being employed in an engine of the type adapted to be supplied with kerosene and air. From the piston head, J, extends a rod, L, which passes through the boss, j^2, and to the end of this rod is fitted a cross arm, L', which is adjustably fastened thereon by suitable nuts, e'. Links, m, m', are pivoted to the respective ends of the cross

arm, L′, and these links in turn are pivoted to shifting rods, M, M′, the former being connected to a series of arms, *n*, which are associated with the fuel valves, *n′*, of the engine, while the other shifting rod, M′, is connected to the arms, *o*, which operate the air valve, *o′*, of said engine. It will be understood that the cross arm, L′, may be connected to only one valve, or to one series of valves, but in Fig. 1, this cross arm is represented as operating two series of valves, the valves of one series controlling the inlet of fuel to the engine, and the valves of the other series regulating the admission of air to the engine.

When the engine is rotating at normal speed, the centrifugal governor is, also, rotated by the gear connections with the engine shaft, *e*, but the sliding member of the governor turns idly in the fork, *d′*, of the switch lever, B, the latter assuming practically the position shown in Fig. 3, wherein the contact, *g*, does not engage with the contact *g′*, thus breaking the circuit, C, and permitting the electro-magnet, D, to remain at rest. Should the engine shaft rotate at a speed above the normal, the spring members of the governor are thrown outwardly and the head, b^4, is moved endwise, thereby operating the switch lever, B, so as to close the electric circuit, C, by bringing the contact, *g*, into engagement with the contact, *g′*. Current is thus admitted to the coil of the electro-magnet, and the core is thereby energized for the purpose of drawing the plunger, D^3, and the piston, J, in one direction, whereby the cross arm, L′, is moved for the purpose of operating the air and fuel valves of the engine, E. It should be noted that the pneumatic check or dash pot retards the movement of the plunger and secures a steady uniform operation of said plunger in either direction, thus opening or closing the engine valve or valves in like manner.

In Figs. 5, 6, and 7 of the drawings, I have shown a mechanical tension device which is associated with the switch lever, B′, and the centrifugal governor, A′, whereby the movement of the switch lever under the action of the governor is opposed so as to prevent the circuit from being closed too quickly by the motion of the engine shaft. The tension device includes a cross rod, P, on the long arm of the switch lever, B′, and to the end portions of this cross rod are fastened springs, Q, the other ends of which are provided with cords, *q*, or like flexible connections. These cords are fastened to an arbor, Q′, which is mounted in the casing, *a′*, for rotation therein, whereby the arbor is adapted to coil or wind the cords, *q*, on itself when said arbor is turned in one direction. The arbor is provided at one end with a suitable operating wheel, *q′*, and the arbor is provided, also, with an index, q^2, adapted to traverse the dial, q^3, provided on the outside of the casing for indicating the tension exerted by the springs on the switch lever, B′.

It will be understood that the arbor may be rotated in one direction for coiling the cords, *q*, thereon and distending the springs, Q, Q′, thus placing increased tension on the switch lever, B′, and pressing its forked end into tight frictional engagement with the centrifugal governor, whereby the tension device affords resistance to the spreading of the governor balls and prevents the governor from responding quickly to a slight increase above the normal in the speed of the engine shaft. The arbor of the tension device may be turned in an opposite direction to uncoil the cords partly therefrom and thus slacken the tension of the springs.

In Fig. 6, I have shown the speed controlling mechanism in connection with an internal combustion engine, E′, of that type which employs a carbureter, e^2, adapted to mechanically-mix air with a liquid fuel, such as gasolene. In said figure, a single cylinder engine of the two cycle type is equipped with a single carbureter adapted to be controlled by the regulator mechanism, but it will be understood that the number of cylinders and carbureters may be increased as desired.

Having thus fully described the invention, what I claim as new, and desire to secure by Letters Patent is:

1. In an apparatus of the class described, an inclosed electro-magnet having a plunger, a dash pot piston movable with said plunger and operating in a chamber formed by said inclosed magnet, means for regulating the flow of air to and from said chamber, a controlling device operated by said plunger, a circuit for energizing the magnet, and automatic switch mechanism for making and breaking the circuit.

2. In an automatic speed controller, an internal combustion engine, an engine-shaft, separate valve mechanisms for controlling the supply of air and fuel, respectively, to the cylinders of said internal combustion engine, an electro-magnet having a movable element, separate connections from said movable element, with the respective valve mechanisms, a centrifugal governor operatively connected with said engine-shaft, an electric circuit including said electro-magnet, and a circuit breaking lever included in said electric circuit and mechanically connected to said centrifugal governor.

3. In an automatic speed controller, an internal combustion engine, an engine shaft, a valve mechanism for controlling the admission of fuel to said engine, another valve mechanism for regulating the inlet of air to

said engine, an electro-magnet having a movable element, separate connections intermediate said movable element and the respective valve mechanisms, a mechanical governor operated by the engine shaft, an electric circuit including said electro-magnet, a circuit breaking lever interposed in said circuit and connected directly to said governor, a spring attached to said lever, and adjusting means connected to the spring for varying the tension thereof.

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

HARRY HERTZBERG.

Witnesses:
H. I. BERNHARD,
JAS. H. GRIFFIN.