No. 685,039. Patented Oct. 22, 1901.

T. M. FOOTE.

SPEED CONTROLLER FOR ENGINES.

(Application filed Apr. 29, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

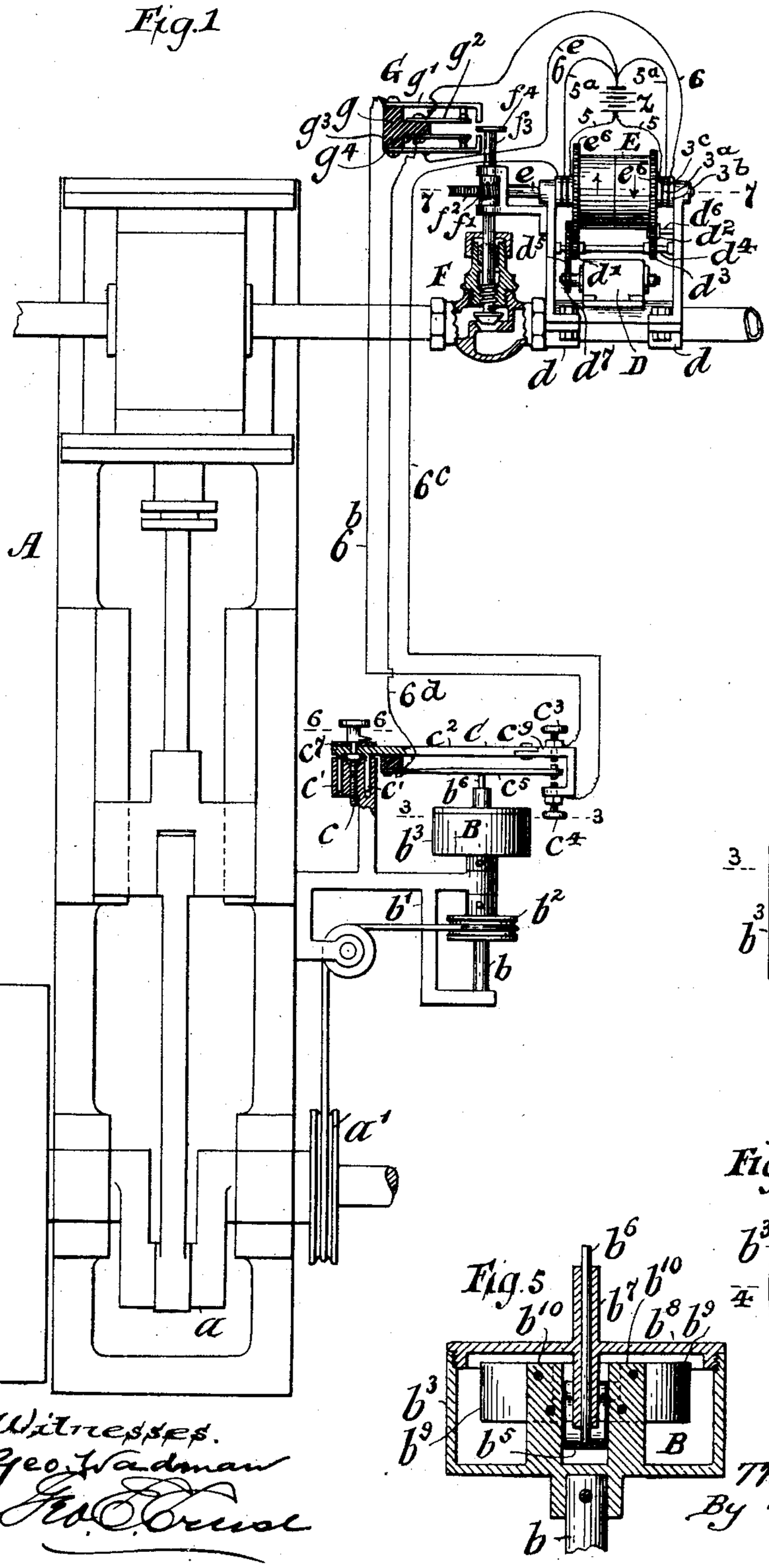

Fig. 2

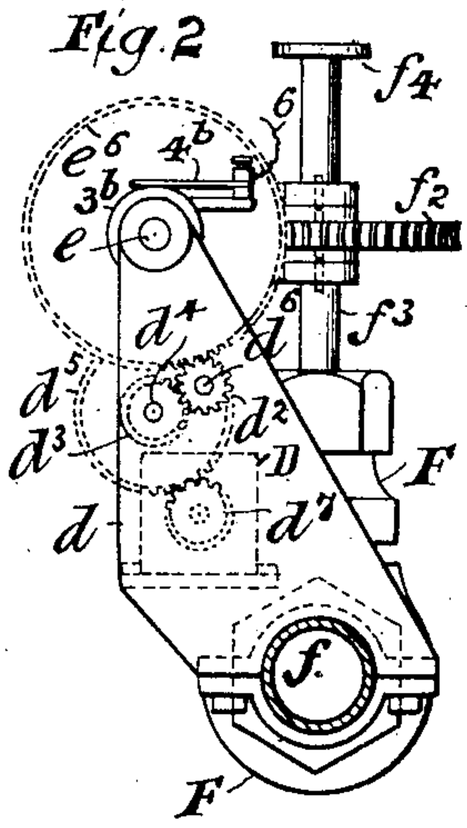

Fig. 6

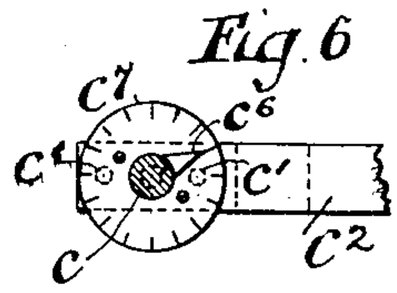

Fig. 4

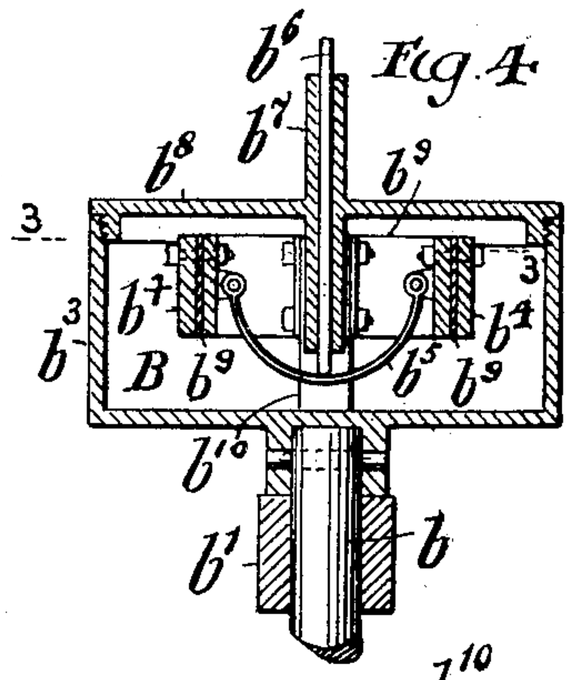

Fig. 3

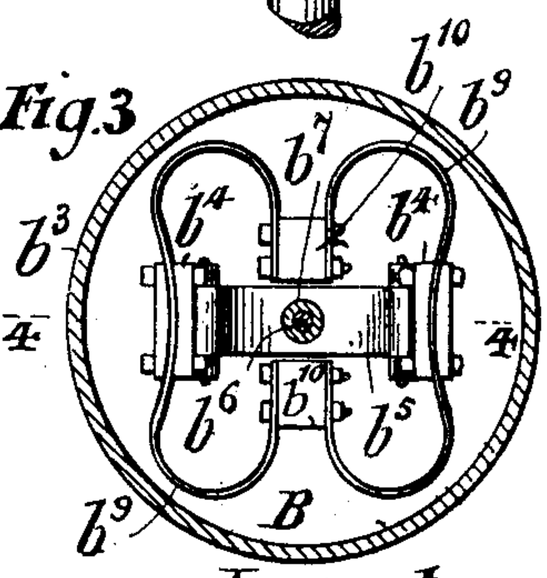

Fig. 5

Witnesses.
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SPEED CONTROLLER FOR ENGINES.

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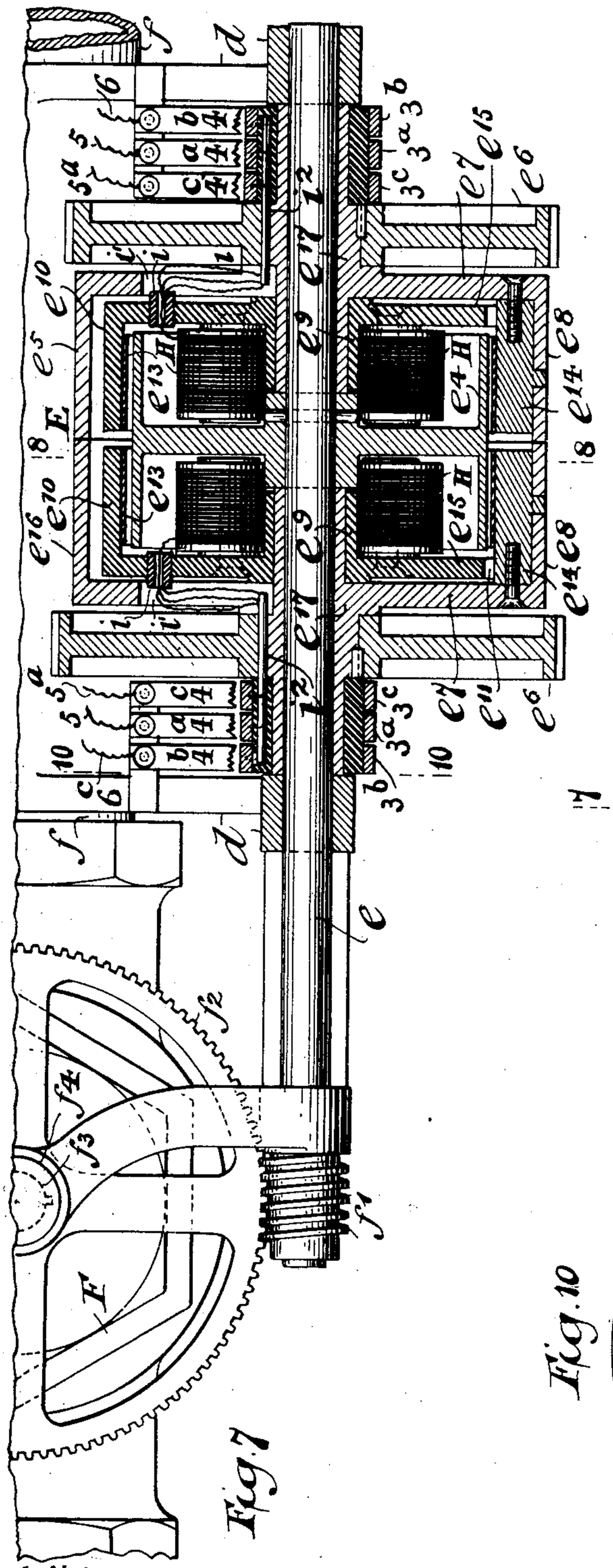

Fig. 7.

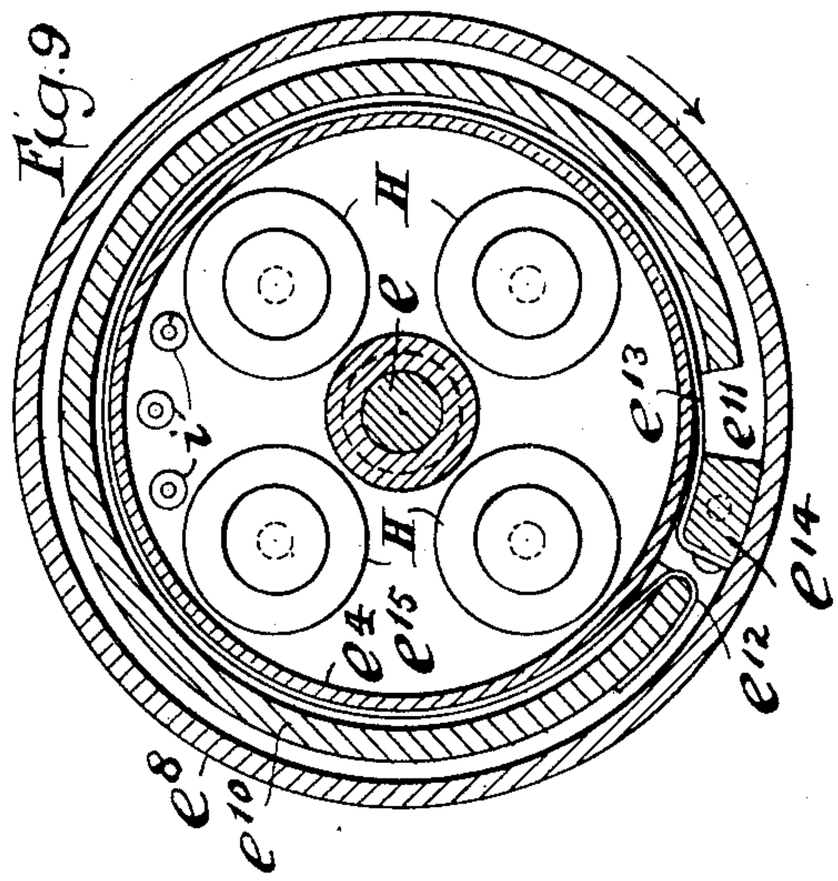

Fig. 9.

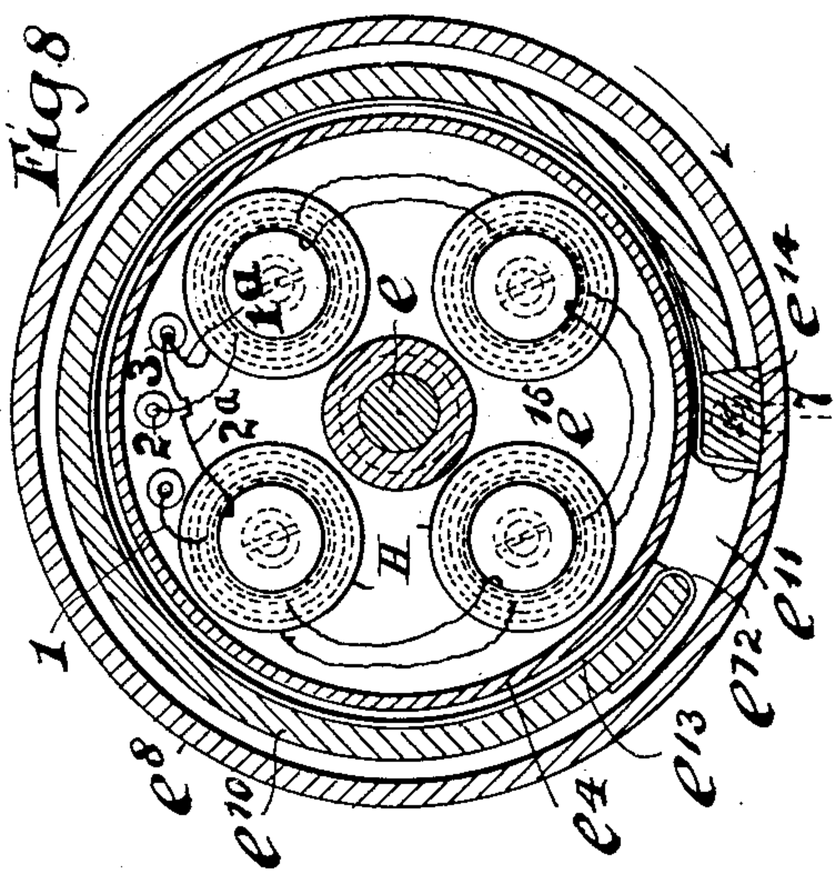

Fig. 8.

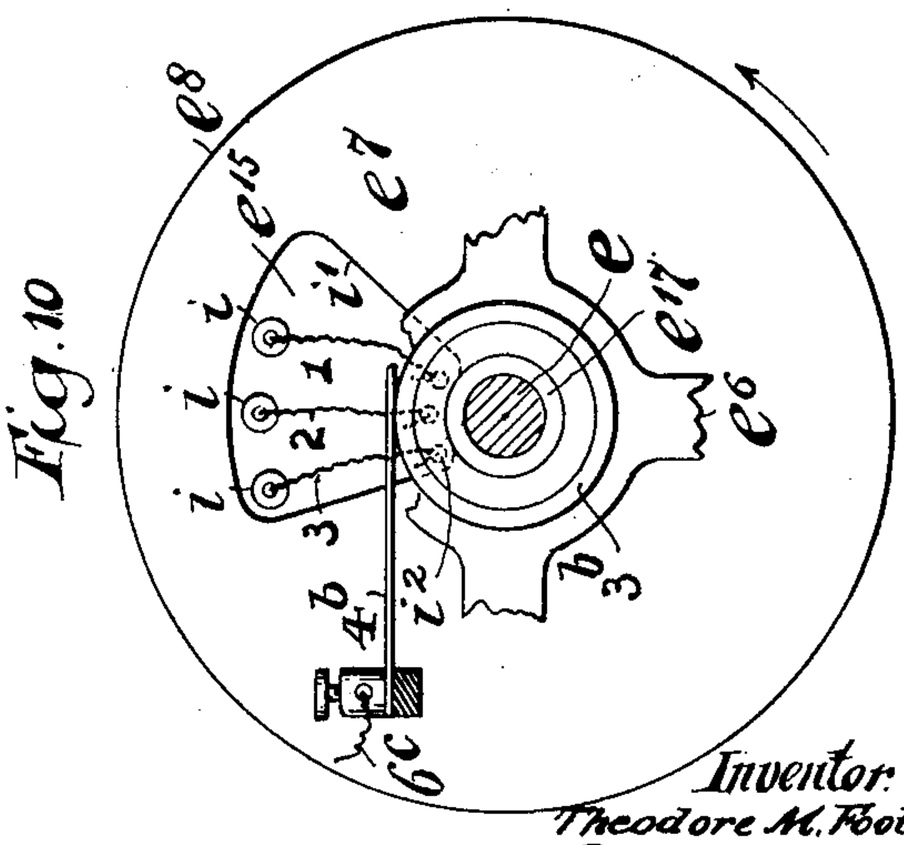

Fig. 10.

Witnesses.
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UNITED STATES PATENT OFFICE.

THEODORE M. FOOTE, OF BROOKLYN, NEW YORK, ASSIGNOR TO EDWIN H. BROWN, OF NEW YORK, N. Y.

SPEED-CONTROLLER FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 685,039, dated October 22, 1901.

Application filed April 29, 1899. Serial No. 714,933. (No model.)

To all whom it may concern:

Be it known that I, THEODORE M. FOOTE, a citizen of the United States of America, residing in the borough of Brooklyn, city and State of New York, have invented certain new and useful Improvements in Speed-Controllers for Engines, of which the following is a specification.

My invention relates to a speed-controller for engines.

I will describe a speed-controller embodying my invention and then point out the novel features in the claims.

In the accompanying drawings, Figure 1 is a front elevation of a marine engine having a speed-controller embodying my invention connected therewith, which device is shown partly in section. Fig. 2 is a side elevation of the steam-supply valve and a means for operating it. Fig. 3 is an enlarged sectional view of a governor taken in a horizontal plane indicated by the line 3 3, Figs. 1 and 4. Fig. 4 is a vertical sectional view of the same in a plane indicated by the line 4 4, Fig. 3. Fig. 5 is a view similar to Fig. 4, but taken in a plane at right angles to Fig. 4. Fig. 6 is a detail horizontal sectional view on the line 6 6, Fig. 1. Fig. 7 is a part top and part horizontal sectional view taken on the line 7 7 of Fig. 1. Fig. 8 is a transverse vertical sectional view taken on the line 8 8, Fig. 7. Fig. 9 is a view similar to Fig. 8, but showing the parts in a different position. Fig. 10 is a transverse vertical sectional view on the line 10 10, Fig. 7.

Similar characters of reference designate corresponding parts in all of the figures.

A represents a portion of a marine engine, a the driving-crank of the engine, and a' a pulley thereon, which is belted to a governor B. The governor is adapted when the speed of the engine increases to operate a controller C, which in turn closes a circuit through an electrical device E. The electrical device E operatively connects a motor D with a valve F, controlling the steam-supply pipe to the engine.

The governor B comprises a shaft b, journaled in a bracket b' and carrying a pulley b^2, which is belted with the pulley a', so that it is rotated. To accomplish this, the shaft b carries a circular casing b^3, in which are mounted weights b^4 so arranged that when the casing is rotated they will move outward through centrifugal force. The weights may be carried by resilient loop b^9, affixed to uprights b^{10} and connected by a strap b^5, which tends to straighten when the weights move outward. Resting on this strap is one end of a vertically-moving rod b^6, which is loose in a bushing b^7, carried by the top b^8 of the casing b^3. The upper end of the rod is adapted to actuate an arm of a controller C.

The controller C may be carried by the bracket b' and have a vertical adjustment thereon by means of the screw c. c' represents pins which fit in openings in the bracket b' and prevent horizontal movement of an arm c^2 relatively to the bracket. The outer end of the arm c^2 has affixed to it an insulated portion c^9, which carries contact-points c^3 c^4. c^5 represents an arm carried by and insulated from the arm c^2 and having its free end projecting between the contact-points c^3 c^4. This arm is engaged by the rod b^6, and its normal position is as shown in Fig. 1, in which position the governor is rotating at the desired speed of the engine. Should the speed of the engine increase, the governor would operate to move the arm c^5 against the contact-point c^3, and should the speed of the engine decrease the governor would operate to allow the arm c^5 to move against the contact c^4. In either case the arm c^5 would close a circuit through the electrical device E, which would then operatively connect the motor D with the valve F to move the valve F to shut off or admit more steam to the engine. By raising or lowering the arm c^2 the governor could be made to act more slowly or quickly on the arm c^5. I have provided the screw c with a pointer c^6, which moves over a dial c^7 on the arm c^2. The dial is graduated to indicate different speeds of the engine, so that by setting the pointer on the dial to any speed the arm c^2 will be adjusted accordingly, so that the engine will be maintained at that speed, for an increase or decrease in speed will tend to operate the controller to cause the valve to open or close.

F represents the steam-valve, located in the steam-supply pipe f. The valve is raised and

lowered to its seat by means of the motor D through the electrical device E. The electrical device E is preferably an electromagnetic friction-clutch, and its power-shaft, which is rotated in reverse directions, is provided with a worm f', which operates a worm-gear f^2 on the valve-stem f^3. The valve-stem is provided with a flanged head f^4, which moves between two arms of a supplemental controller G. This controller is in circuit with the controller C, as will be hereinafter described, and it is adapted to open the circuit to the clutch when the valve reaches the limit of its movement in either direction. This controller G comprises the insulated part g, to which are connected the arms g', g^2, g^3, and g^4. The arms g' g^2 are in contact, as are the arms g^3 and g^4, and the arms g' and g^4 are adapted to be engaged by the flanged head to move these arms out of contact with the arms g^2 g^3.

D represents a motor which is operated continuously or as long as the marine engine is to be operated. It may for convenience be mounted on brackets d, that are secured to the steam-pipe, and it is adapted to operate the rotatable parts of the electrical device E. The electrical device E comprises two parts e^5 and e^{16}, and these two parts are rotated by the motor D, each being provided with a gear e^6. One gear e^6 meshes with a pinion d', affixed to a counter-shaft d^4, to which is affixed a gear d^5, meshing with a pinion d^7 on the shaft of the motor, so that its part will rotate in one direction, while the other gear-wheel meshes with a pinion d^2 on a stud d^6, which in turn meshes with the pinion d^3 on the counter-shaft d^4, so that its part will go in a reverse direction. These two parts e^5 and e^{16} rotate about the shaft e of the clutch, which is journaled in the brackets d and carries the worm f'. The shaft also carries a pulley e^4, the web portion of which is preferably without openings, and this pulley is adapted to be moved with either of the parts e^5 or e^{16}. The parts e^5 e^{16} are of the same construction, so that the following description of one part will apply equally well to the other part. The gear e^6 is keyed to a sleeve e^{17}, which sleeve is loose upon the shaft e, and it carries a circular plate e^7, having a peripheral flange e^8. e^9 represents a sleeve loose upon the sleeve e^{17} and carrying a plate e^{15}, provided with a peripheral flange e^{10}, which is inclosed by the flange e^8. The flange e^{10} is cut away, as shown at e^{11}, to receive the bent end e^{12} of a strap or band e^{13}, the other end of which band is connected to a block e^{14}, that is secured to the flange e^8. The cut-away portion of the flange e^{10} also accommodates the block e^{14}. As shown, the band or strap e^{13} loosely surrounds the flange of the pulley e^4, and when there is a relative movement between the flanges e^8 and e^{10} the band will be tightened about the pulley. When this is done, the pulley will be caused to rotate with that part whose band or strap e^{13} has been tightened about it. The relative movement between the two parts may be caused by electromagnets H, which are carried by the plate e^{15}. When the electromagnets are energized, they attract the web of the pulley, which, being at rest and under friction due to the meshing of the worm f' with the worm-gear f^2, will retard the rotary movement of the plate. The plate e^7, moving constantly, will then cause the band or strap e^{13} of that part to be tightened about the pulley, and thus through friction cause it to rotate with the plate.

Each of the magnets H is provided with two windings, which are shown conventionally in Fig. 8. The inner winding is of a finer wire than the outer. The inner windings contain current all the time, so as to have the cores energized. The magnetism thus produced is not sufficient to attract the web of the pulley and is only for the purpose of discharging any magnetism produced by the outer winding and remaining in the core after the current has cut out the outer winding. An opposite magnetism is therefore required to do this, and this opposite magnetism may be produced by having the inner coil of wire wound in a direction opposite to that of the outer coil or by having both coils wound in the same direction and pass current through the coils in opposite directions.

As shown in Fig. 8, the windings are connected, and the terminals are passed through eyes i of insulation carried in the plate e^{15} through an opening i' in the plate e^7 through rods i^2, which are located in a ring of insulation on the sleeve e^{17}. As shown, one terminal of the inner winding and one terminal of the outer windings are joined, so that there need be only three insulated eyes and three tubes. For convenience I have designated the terminals of the outer winding by the reference characters 1 1^a and the terminals of the inner winding 2 2^a. The terminals 1^a and 2^a are combined, and this combined terminal I have designated by the reference character 3. The three terminals are connected with rings or bands 3^a, 3^b, and 3^c, the terminal 1 being connected with the band or ring 3^b, the terminal 2 with the band or ring 3^c, and the combined terminal 3 with the ring 3^a. Contact-fingers 4^a, 4^b, and 4^c bear on the rings or bands 3^a, 3^b, and 3^c, respectively. The contact-fingers 4^a 4^c of each part of the clutch may be connected by suitable conductors 5 and 5^a, respectively, and these conductors are connected with the terminals of a battery Z, so that with this arrangement of the circuits current will always be in the inner windings of the magnet. The contact-finger 4^b on one part of the clutch is connected by a conductor 6 with the arm g^2 of the controller G, and the arm g', which is in contact with the arm g^2, is connected by a conductor 6^b with the contact c^3 of the controller C. The contact-finger 4^b on the other part of the clutch is connected by a conductor 6^c with the contact-fin-

ger c^4 of the controller C. The arm c^5 of the controller C is connected by conductor 6^d with the arm g^3 of the controller G, and the arm g^4, which is in contact with the arm g^3, is connected by a conductor 6^e with one terminal of the battery. Thus it will be seen that the circuit through the outer windings of the magnets is normally open by reason of the central position of the arm c^5. As soon, however, as the arm is moved in one direction or the other the circuit will be closed through the outer windings of the magnets on either part of the clutch, according to which direction the arm c^5 is moved and that part of the clutch operated to move the valve. As the valve is moved and reaches its limit of movement its flanged head engages either the arm g' or g^4 and opens the circuit through the outer windings of that part of the clutch which is in operation and prevents its further operation.

What I claim as my invention is—

1. In combination with an engine, a valve for controlling the supply of steam thereto, a motor, an electromagnetic clutch having two oppositely-rotating parts for operatively connecting the motor with said valve, said two parts being constantly rotated by the said motor, a controller for said electromagnetic clutch having an adjustable part, a device for indicating the amount of adjustment, and a governor connected with the engine for actuating said controller.

2. In combination with an engine, a valve for controlling the supply of steam thereto, a motor for operating said valve, an electrical device for connecting said motor to said valve, said electrical device comprising a power-shaft a pulley on said shaft, a pair of friction-bands surrounding said pulley, two oppositely-rotating parts, each carrying a band, and adapted to tighten the band about the pulley and a controller for said electrical device operated by the governor of the engine.

3. In combination with an engine, a valve for controlling the supply of steam thereto, a motor and electrical device intermediate the motor and valve for operatively connecting the motor to said valve, said electrical device comprising a pulley, two friction-bands surrounding said pulley and rotating in opposite directions, electromagnets and means for tightening each of said bands around the pulley, and a controller for governing which of said bands shall be tightened, said controller being actuated by the governor of the engine.

4. In combination with an engine, a valve for controlling the supply of steam thereto, a motor, an electrical device for operatively connecting said motor with the valve, said device comprising a shaft which is connected with the valve-stem, two oppositely-rotating parts mounted on said shaft which parts are constantly rotated by said motor, means for coupling said shaft with either of said rotating parts, and a controller for said electrical device, which is actuated from the governor of the engine.

5. In combination with an engine, a valve for controlling the supply of steam to said engine, a motor, an electrical device for operatively connecting the motor with said valve, said electrical device comprising a shaft which is geared to said valve, two oppositely-rotating parts loosely mounted on said shaft, means comprising electromagnets carried by each of said parts for coupling it to the shaft, a circuit and source of power for said magnets, and a plurality of controllers in said circuit one of which is actuated by the governor of the engine and the other adapted to be actuated by the valve at the limit of its movement in either direction.

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

THEODORE M. FOOTE.

Witnesses:
W. LAIRD GOLDSBOROUGH,
GEO. E. CRUSE.