No. 781,154. PATENTED JAN. 31, 1905.

C. A. PARSONS & J. SWINBURNE.

METHOD OF CONTROLLING THE RUNNING OF RECIPROCATING ENGINES OR TURBINES DRIVING ALTERNATORS IN PARALLEL.

APPLICATION FILED MAR. 30, 1903.

3 SHEETS—SHEET 1.

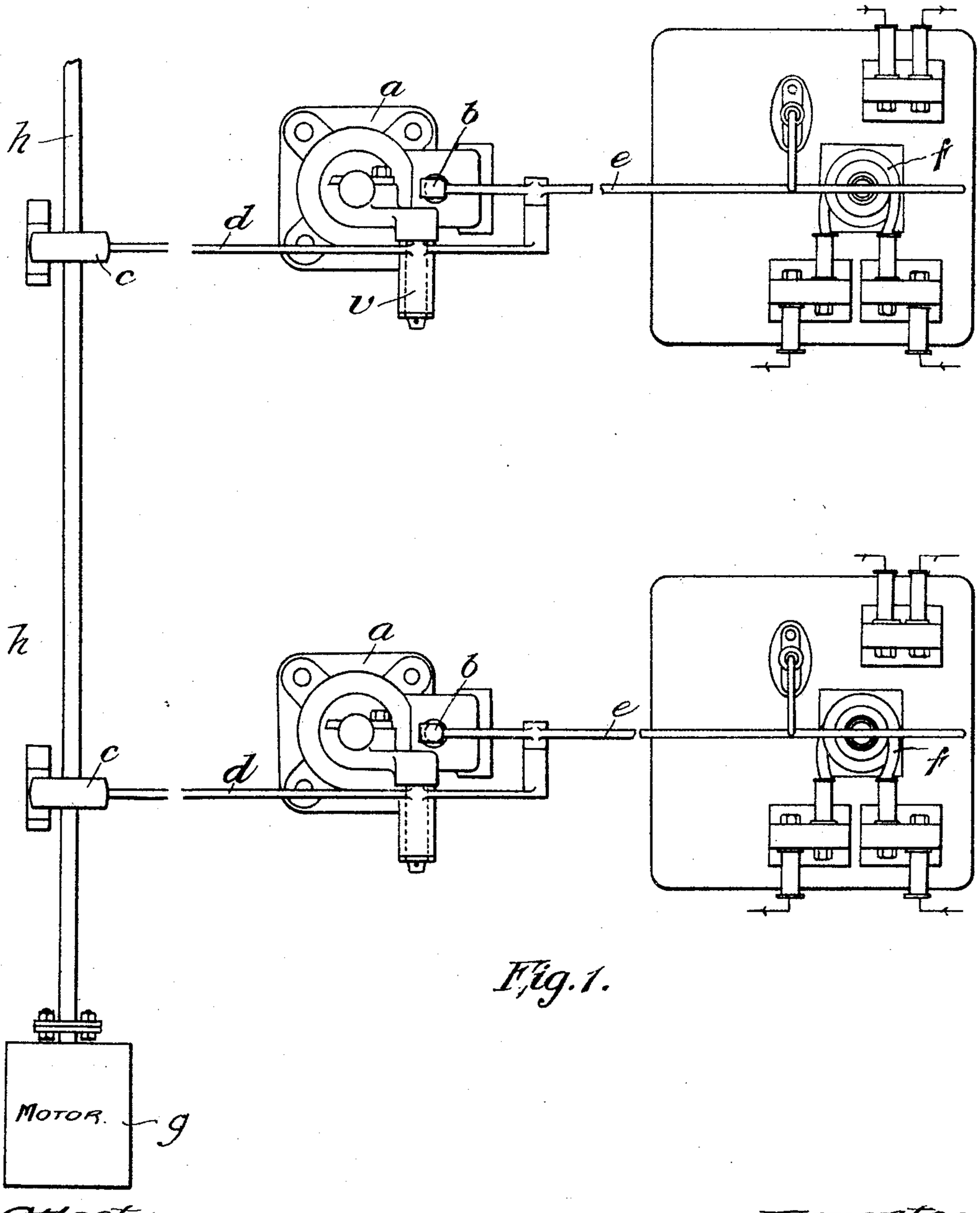

Fig. 1.

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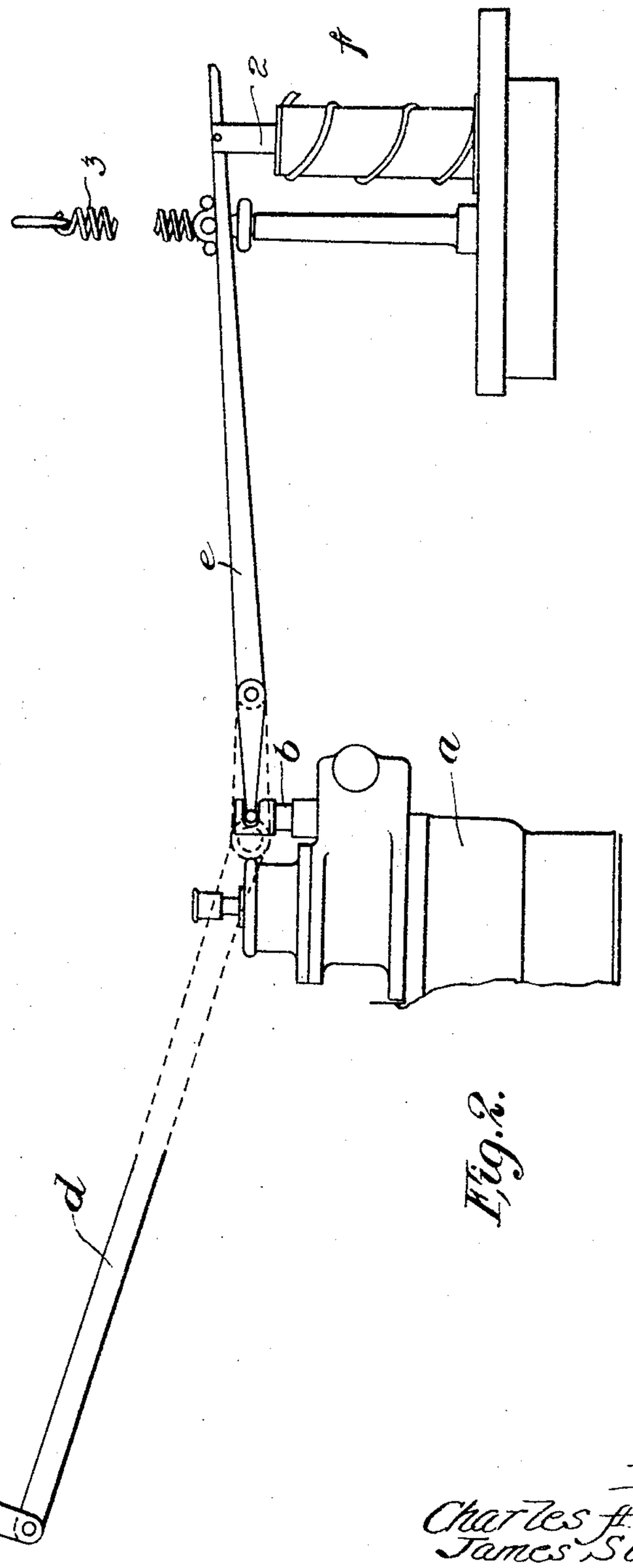

Fig. 2.

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3 SHEETS—SHEET 3.

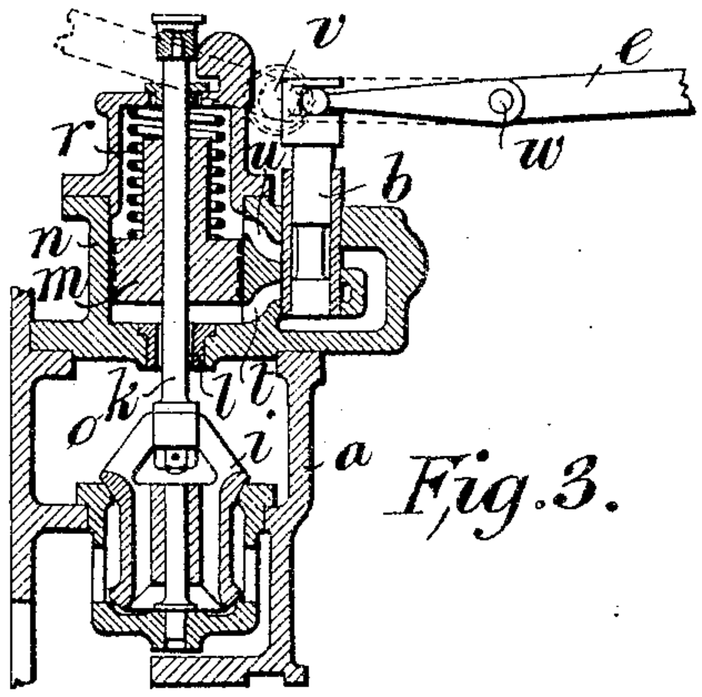
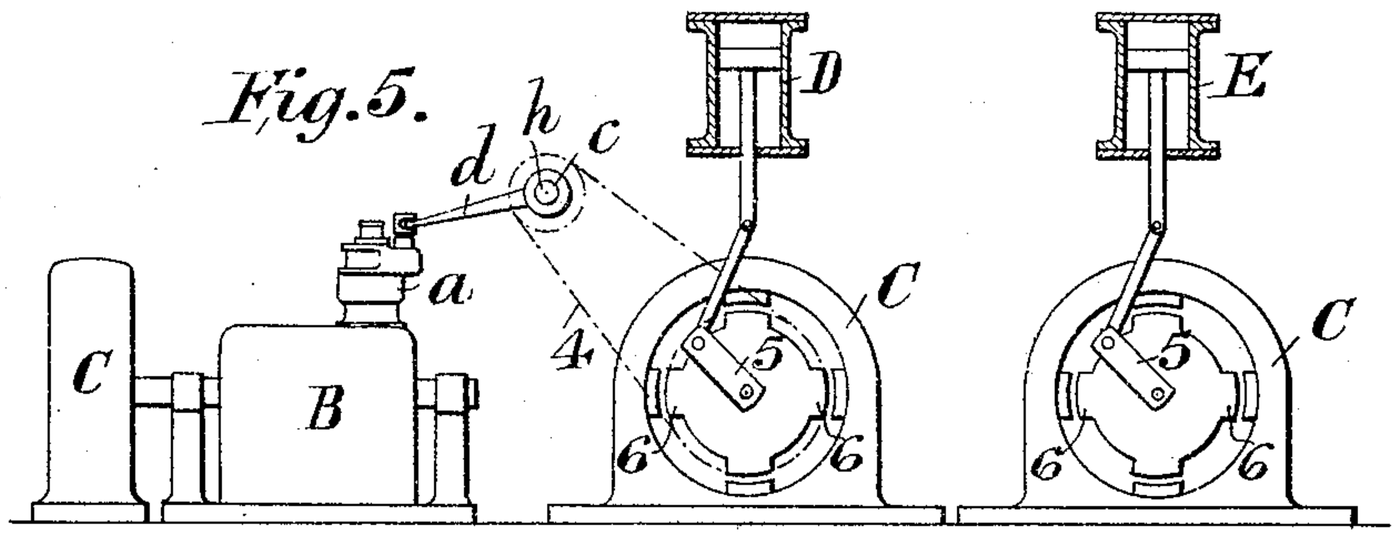


Fig. 3.



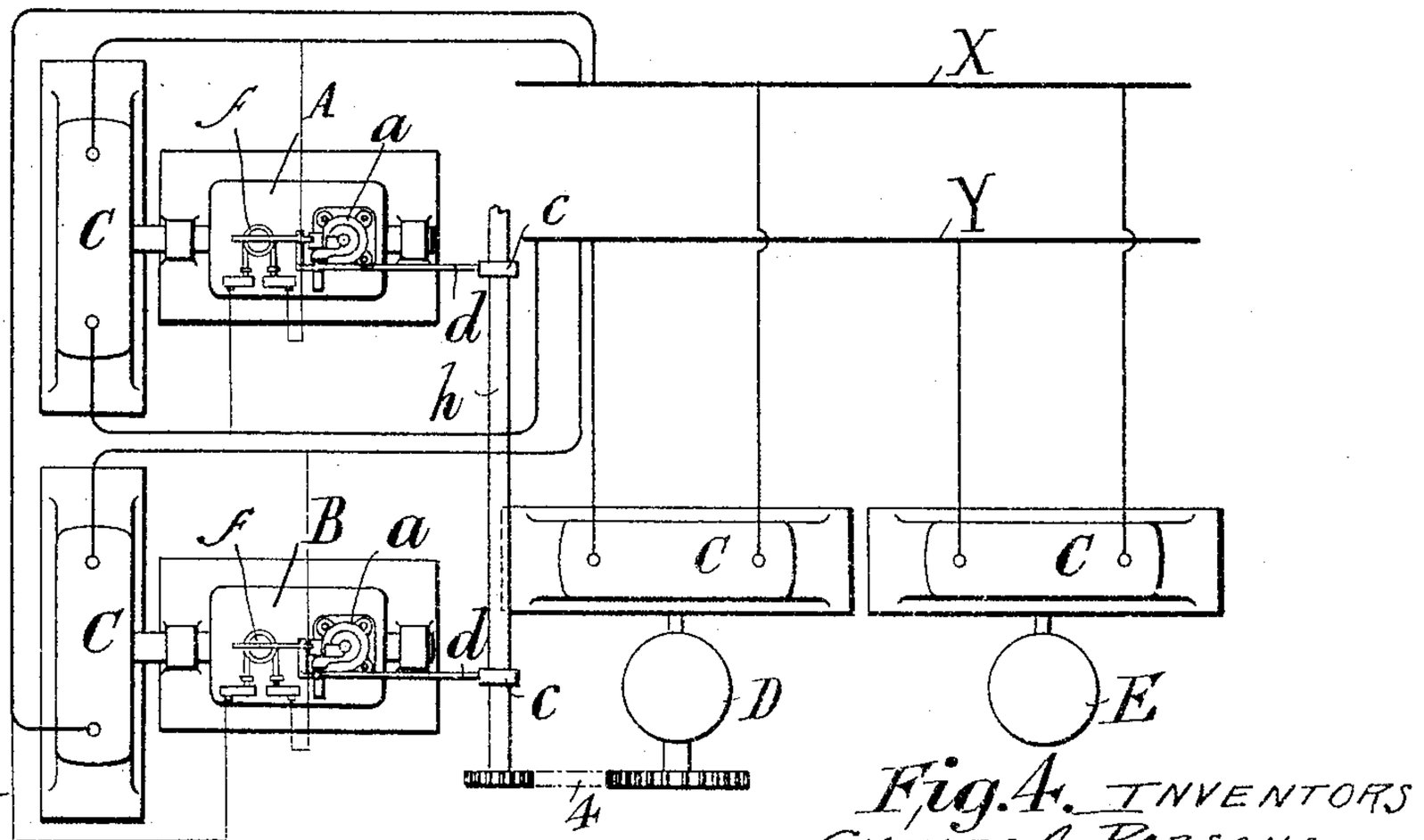


Fig. 4.

ATTEST

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No. 781,154. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, AND JAMES SWINBURNE, OF LONDON, ENGLAND; SAID SWINBURNE ASSIGNOR TO SAID PARSONS.

METHOD OF CONTROLLING THE RUNNING OF RECIPROCATING ENGINES OR TURBINES DRIVING ALTERNATORS IN PARALLEL.

SPECIFICATION forming part of Letters Patent No. 781,154, dated January 31, 1905.

Application filed March 30, 1903. Serial No. 150,297.

To all whom it may concern:

Be it known that we, CHARLES ALGERNON PARSONS, residing at Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, and JAMES SWINBURNE, residing at 82 Victoria street, London, S. W., England, subjects of the King of Great Britain and Ireland, have invented a certain new and useful Improved Method of Controlling the Running of Reciprocating Engines or Turbines Driving Alternators in Parallel, (for which we have made application for Letters Patent in Great Britain, No. 19,031, dated the 29th day of August, 1902,) of which the following is a specification.

This invention relates to an improved method of controlling elastic-fluid turbines either alone or together with reciprocating engines when driving alternators in parallel.

In alternators driven by turbines (to which the working fluid is admitted in a series of impulses or puffs) and coupled in parallel difficulty is experienced in practice owing to interchange currents between the individual generators due to non-synchronous variations of velocity in the different turbines. This difficulty is accentuated if turbines and reciprocating engines are used together for the driving of alternators in parallel. If reciprocating engines are used alone, the difficulty can be overcome in a known manner by coupling each alternator direct to the engine driving it in such a way that the same phase relations between the engine-cranks and their coöperating alternator elements are maintained constant in each set. If, then, such units are connected in parallel, their cranks will pass simultaneously through the dead-points and the engines will develop their maximum turning moments together, the alternators then running in phase with minimum interchange currents.

The object of the invention is to provide an arrangement which renders it possible to drive alternators in parallel either by two or more turbines alone or in conjunction with reciprocating engines, so as to reduce the interchange currents to a minimum. To carry this into effect, puffing-valves of known construction are used for the control of the turbines, the puffing-valves being operated from a suitably-driven shaft in such a way that they open and close simultaneously, while the regulation of the amount of steam passed by each valve is also effected simultaneously, but by means independent of those used for securing the simultaneity of the puffs. If a reciprocating engine is used in conjunction with the turbines, then the shaft which drives the puffing-valves must be driven from a part of the reciprocating engine in such a way that the maximum turning moments of the turbines and the reciprocating engine fall together. If a plurality of reciprocating engines is used, they must be arranged among themselves in the known manner described above and the shaft which drives the puffing-valves must be driven from a suitable part of some one of them.

Referring to the accompanying drawings, Figure 1 is a plan showing two turbines controlled in the manner described, Fig. 2 being an elevation of the same. Fig. 3 is a vertical section through the controlling-valve of Figs. 1 and 2, while Figs. 4 and 5 show diagrammatically, in plan and elevation, the method of control when turbines and reciprocating engines are used in the same installation.

In carrying the invention into effect according to one form each turbine A B is supplied with a separate admission-valve contained in a casing *a* and controlled by a secondary valve *b*, actuated by an eccentric *c* and levers *d* and *e*, all of the general type described in Parsons's patent, No. 549,816. The admission-valve *i* in each turbine (see Fig. 3) is of the double-beat or other balanced type and is connected, by means of a rod *k*, passing loosely through a bush *l*, to a piston *m* in a closed cylinder *n*. Steam enters the steam-chest *o* from the supply-pipe and passes thence into the cylinder

n below the piston m by way of the loose bush l. The piston m is pressed down by means of a strong spring r, which tends to close the valve i down onto its seat and to cut off the steam-supply from the engine. A small outlet-valve b controls the escape of steam from the cylinder n by way of the ports $t\ u$, this valve b being actuated in the manner to be hereinafter described. When the valve b is closed, the steam entering the cylinder past the sleeve l raises the piston m and opens the main valve i; but when the valve b is open the steam escapes through the ports $t\ u$ faster than it can enter past the bush l, and the spring r consequently forces down the piston m, closing the main valve i. For intermediate positions of the small valve b the main valve i assumes corresponding position of partial opening. Instead of or in conjunction with the loose bush l an adjustable tap may be used to control the steam entering the cylinder n.

The valve b of each turbine is given a slight reciprocating motion from an eccentric c on a shaft h by means of a lever d, pivoted at v, and a lever e, connected at w to the end of the lever d and yieldingly pivoted at x. This reciprocating movement of the valve b causes a corresponding movement of the main valve i, and consequently an intermittent admission of steam to each turbine consisting of a series of puffs, the levers and eccentrics being so set that the puffs are simultaneous in the different turbines.

Each turbine is provided with a governing device consisting of a solenoid f, with a core 2, attached to the end of the lever e. The position of the point x, about which the lever e rocks, is determined by the current in the solenoid f, the resulting magnetic pull on the core 2 being balanced by a spring 3. This adjustment of the point x causes a corresponding alteration in the position of the valve b with regard to the eccentric c, varying the duration of each puff admitted to the turbine. A motor g is provided, which drives the shaft h, on which all the eccentrics c are mounted. The solenoids f may be energized by the alternating current generated and are then preferably connected as a shunt across the terminals of their respective generators in the manner indicated in Fig. 4. The solenoid-governor above described is shown by way of example; but any other known type, mechanical or electrical, may be used to control the volume of steam admitted at each puff so long as the governing is effected simultaneously in each turbine.

This invention may be applied to any turbine to which the elastic fluid is admitted in puffs or blasts, the essential feature being that the admission of the elastic fluid takes place simultaneously in all the turbines, while the governing is also effected simultaneously in all, but by independent means.

Figs. 4 and 5 show the invention applied to the case where turbines and reciprocating engines are used in a mixed installation. Thus the alternators C are shown connected in parallel to the bus-bars X Y, two of them being driven by turbines A B and two by reciprocating engines D E. The shaft h, from which the puffing-valves are operated, is in this case driven from one of the reciprocating engines, D, instead of by the motor g—as, for instance, by the chain 4; but any other form of gearing may be used which is adapted to transmit the required motion. The parts are so set that the opening of the puffing-valves and the development of the maximum turning moments of the reciprocating engine fall together as often as possible. Thus, for instance, two puffs might occur for every point of maximum turning moment, or vice versa, according to the exigencies of design.

If a plurality of reciprocating engines is used in conjunction with turbines, the cranks 5 of each engine must be set in the same definite relation to the magnets 6 or other revolving parts of the alternators. The reciprocating engines will then develop their maximum turning moments simultaneously, owing to the electrical control effected by the alternators on each other.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In combination, a plurality of alternators in parallel, elastic-fluid turbines for driving part of said alternators, other motors for driving the balance of said alternators, means for admitting to said turbines puffs simultaneous with the maximum turning moments of the other alternator-driving motors, and governing means independent of the means employed for securing such simultaneity, substantially as described.

2. In combination, a plurality of alternators in parallel, elastic-fluid turbines for driving part of said alternators, reciprocating engines for driving the balance, means for admitting to each of said turbines puffs simultaneous with the maximum turning moments of the reciprocating engines, and governing means independent of the means employed for securing such simultaneity, substantially as described.

3. In combination, a plurality of alternators in parallel, elastic-fluid turbines for driving the same, means for admitting to the turbines simultaneous puffs of elastic fluid, independent means for regulating the duration of said puffs, substantially as described.

4. In combination, a plurality of alternators in parallel, elastic-fluid turbines for driving the same, means including a shaft for admitting to the turbines simultaneous puffs of elastic fluid, a motor other than said turbines for driving said shaft together with independ-

ent means for regulating said puffs, substantially as described.

5. In combination, a plurality of alternators in parallel, elastic-fluid turbines for driving certain of same, one or more reciprocating engines for driving the balance, means including a shaft for admitting to each of said turbines puffs simultaneous with the maximum turning moments of said reciprocating engines, said shaft being driven by one of said reciprocating engines, together with independent means for regulating said puffs, substantially as described.

In witness whereof we have hereunto set our hands in presence of two witnesses.

CHARLES ALGERNON PARSONS.
JAMES SWINBURNE.

Witnesses to the signature of the said Charles Algernon Parsons:

JOHN GEORGE NICHOL,
ANNIE STILL.

Witnesses to the signature of the said James Swinburne:

DOROTHY LOUGHNAN,
BERTRAM H. MATTHEWS.