(No Model.)

L. M. SANDERS.

ELECTRICAL APPARATUS FOR CONTROLLING MARINE ENGINES.

No. 326,337. Patented Sept. 15, 1885.

Fig. 1.

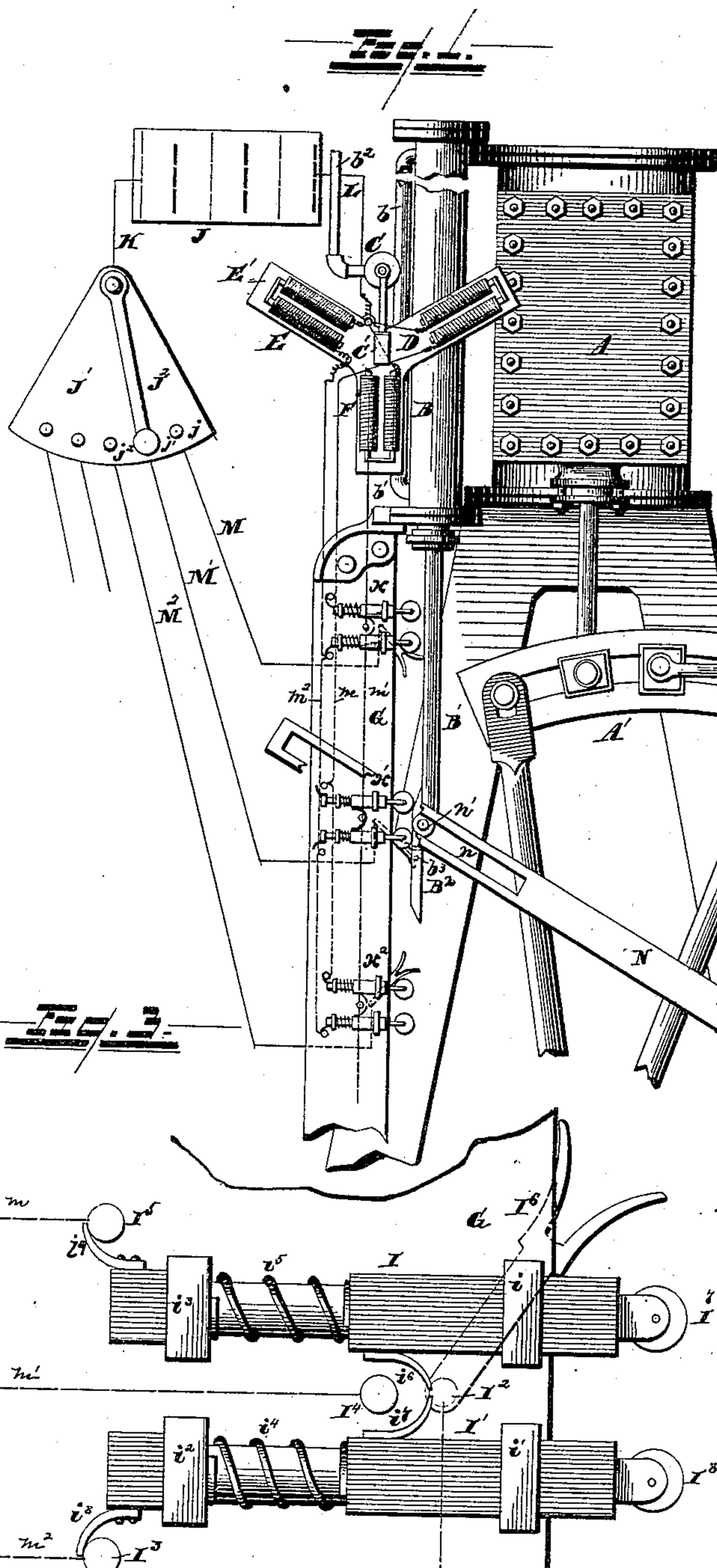


Fig. 2.

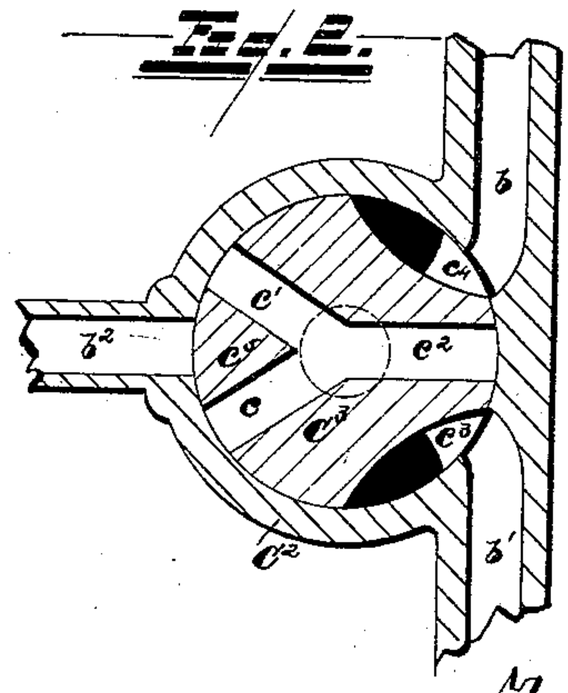
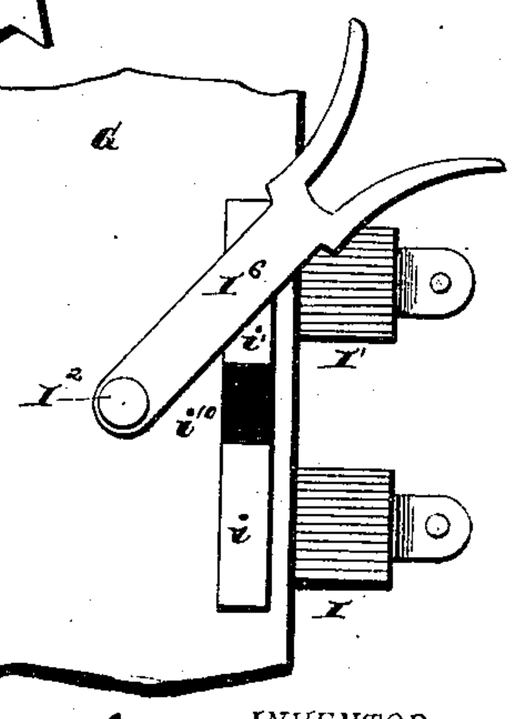


Fig. 3.

Fig. 4.



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ELECTRICAL APPARATUS FOR CONTROLLING MARINE ENGINES.

SPECIFICATION forming part of Letters Patent No. 326,337, dated September 15, 1885.

Application filed March 31, 1885. (No model.)

To all whom it may concern:

Be it known that I, LOUIS M. SANDERS, of Roseville, county of Macomb, State of Michigan, have invented a new and useful Improvement in Electrical Apparatus for Controlling Marine Engines; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form a part of this specification.

My invention is designed to provide an electrical apparatus whereby the operation of a marine engine may be controlled directly by the captain or pilot without the necessity of signaling to the engineer; and it consists in the novel combinations of devices and appliances connected with the "link-motion" for accomplishing this design, as more fully hereinafter described, and more particularly pointed out in the claims.

In the drawings, Figure 1 is a front elevation of a device embodying my invention. Fig. 2 is a separate view of the three-way valve. Fig. 3 is a separate view of one of the commutators. Fig. 4 is a separate view of the escapement-lever in inverted plan.

I carry out my invention as follows:

A is the steam-chest of the engine.

A′ is any desired link-motion for controlling the engine.

a is the ordinary hand-lever by which the engineer operates the link-motion.

B represents a steam-cylinder of any suitable dimensions, located in any desired position relative to the marine engine. B′ is its piston-rod.

b is a port to admit steam to the top of the cylinder; *b′*, a steam-port to admit steam to the bottom of the cylinder, said pipes *b b′* admitting steam alternately thereto, and each communicating with a three-way valve, C. b^2 is an inlet steam-pipe to admit the steam to said valve.

C′ is any suitable armature, preferably a pendulum-armature, controlling the operation of said valve.

I do not limit myself to any specific construction of the three-way valve, as any valve adapted to admit the steam from the inlet-pipe to the ports *b b′* alternately will serve my purpose. I prefer, however, to construct it as more particularly shown in Fig. 2, in which C^2 is the valve-case; C^3, a rotatable valve provided with inlet-orifices *c c′*, converging into an outlet-channel, c^2.

c^3 and c^4 represent exhaust-ports. In the position shown in Fig. 2 the steam is cut off from the ports *b b′*, permitting them to exhaust through orifices c^3 c^4.

I prefer to provide the valve with a lip, c^5, located between the inlet-orifices *c c′*, so that when the steam is cut off from the ports *b b′* it will at the same time be prevented from entering the valve.

It is evident that, by this construction, as the valve is rotated in either direction steam will be admitted through one of the inlet-orifices, *c c′*, and be communicated through the orifice c^2 to one of the ports, *b b′*, and vice versa. The valve itself is operated by means of the armature C′.

D E F represent electro-magnets, the armature being adapted to vibrate between the magnets D and E, or to be held at rest between them over the magnet F. E′ represents any suitable support for said magnets.

As arranged in the drawings, when the armature is over the magnet F, the steam is cut off from the cylinder B; when said armature is attracted to the magnet D, the valve is so rotated as to admit steam to the upper end of the cylinder B, and when the armature is attracted to the magnet E steam is admitted to the lower end of said cylinder.

G represents any suitable support for a series of commutators, H H′ H^2, &c.

J represents a battery for generating the electric current.

J′ represents a switch-board, which may have any desired location—as, for instance, in the pilot-house. J^2 represents a vibratory switch-lever upon said switch-board. *j j′* j^2, &c., represent a series of contact-points on said board, with which said lever may be engaged to complete any desired circuit.

K represents a line leading from the battery to the lever on the switch-board.

L represents a line connecting the magnets D E F to the battery.

M M′ M^2, &c., represent a series of wires leading from the contact-points *j j′* j^2, &c., of the switch-board to the commutators H H′ H^2.

m is a line leading from the commutator to the magnet D; *m'* a line leading from the commutator to the magnet F, and m^2 a line leading from the commutator to the magnet E.

N represents a lever connected with the link-motion in any suitable manner. The hand-lever *a* may be continued in the form of a bell-crank lever for this purpose, if desired.

The lever is provided with an elongated slot, *n*, and is connected to the piston-rod B' by an intervening cross-head, *n'*, traveling in said slot.

B^2 is an elongated cam, which may be secured either to the cross-head or the piston-rod.

I will now proceed to describe one of the commutators, as more particularly shown in Figs. 3 and 4.

Each of the commutators consists, essentially, of two conducting-bars, I I', which reciprocate through the sleeves *i i' i² i³*.

I^2 is a binding-screw connected by a wire with the switch-board.

I^3 is a binding-screw connected by wire with the magnet E.

I^4 is a binding-screw connected by wire with the magnet F.

I^5 the binding-screw connected by wire with the magnet D.

I^6 is an escapement-lever connected with the binding-screw I^2, having pivotal connection therewith, so as to permit its being vibrated to form a contact with either of the sleeves *i i'*.

The reciprocatory bars I I' are provided with retracting-springs i^4 i^5 and with connectors i^6, i^7, i^8, and i^9, preferably made of curved spring metal adapted to complete the circuits through their adjacent binding-screws as the bars are reciprocated in either direction, as the case may be.

The bars I I' are preferably provided with anti-friction insulating-rollers I^7 I^8 to receive the impact of the cam B^2 upon the piston-rod. The escapement-lever is also preferably constructed with forked and curved ends, as shown, to receive the impact of said cam, as it rides past the commutator in either direction.

If the cam B^2 be above a given commutator, the escapement-lever I^6 will have been carried with the upward stroke of the cam into contact with the sleeve *i* of the bar I. On the other hand, if the cam be below a given commutator, the escapement-lever will be carried by its downward stroke into contact with the sleeve *i'* of the bar I'. When the bars I I' are in their normal position, as shown in Fig. 3, with the cam above the commutator, the current from the switch will pass to the binding-screw I^2, and thence through the escapement-lever I^6 to the sleeve *i*, and through the bar I, connector i^9 to the binding-screw I^5, and thence off on the line to the magnet D, attracting the pendulum-armature thereto and admit steam through the three-way valve into the upper end of the cylinder B.

Suppose, now, that the cam is on its downward stroke. As it comes in contact with the bar I, Fig. 3, said bar is driven forward, making the connection with the binding-screw I^4, when the current from the switch will be carried to the magnet F, cutting off steam from the cylinder. At the same time by the downward stroke of the cam the escapement-lever I^6 is carried over, making contact with the sleeve *i'* of the bar I', the bar I' is driven forward, and the circuit completed through said bar and the binding-screw I^4. When the cam has been driven past the commutator, the retracting springs will cause the bars I I' to assume their normal position, and the current from the switch will be cut off from the binding-screw I^4, and consequently from the magnet F and directed through the connection i^8 and binding-screw I^3 to the magnet E. The pendulum-armature will be attracted to said magnet, and steam admitted at the lower end of the cylinder. The connection will be made vice versa on the upward stroke of the cam.

Thus it will be seen, as shown in Fig. 1, that in commutators located above the cam, the escapement-lever I^6 will be thrown down and have contact with the sleeve *i'* of the bar I', in which case the current from the switch would be first directed to the magnet E, and in commutators below the cam said lever will be thrown up in the position shown in Fig. 3, having contact with the sleeve *i* of the lever I, in which position the current from the switch will be first directed to the magnet D.

When the cam is opposite either or both of the bars I I', the current will be directed to the magnet F, cutting off steam from the cylinder altogether.

When it is not desired to have the current from the battery directed to any of the magnets, the switch may be disengaged from all the contact-points on the switch-board in any suitable manner—as, for instance, the lever may be provided with a spring, as shown in dotted lines in Fig. 1, to lift it off from said points when the apparatus is desired to be inoperative, thereby breaking the circuit.

I would have it understood that I do not confine myself to any particular construction of the switch-board or mechanism for completing the circuit through the commutators with the magnets. Nor do I confine myself to any specific construction of the commutators themselves, as commutators may be variously arranged and constructed adapted to complete the desired circuits.

The operation of the device is as follows: Let it be required to change the position of the cross-head *n'*, and consequently the lever N, from the commutator H to the position which it occupies in Fig. 1 of the drawings abreast of the commutator H', locate the vibratory lever of the switch-board upon the contact-point at *j'*, so as to direct the current from the battery through the line M' to the

commutator H'. At the moment of making this connection on the switch-board the bars I I' of the commutator H' are in their normal position (shown in Fig. 3) with the escapement-lever thrown up, as indicated in said figure. The current is thus directed in the manner already explained to the magnet D, the pendulum-armature is attracted thereto, and steam is admitted to the upper end of the cylinder, driving the piston-rod with its cross-head and the lever N downward until the cam comes abreast of the commutator H', when the current will be diverted, in the manner already explained, to the magnet F. The pendulum-armature will then be attracted thereto and the steam be cut off from the cylinder.

Should the cam ride past the commutator H', the current would be diverted, in the manner already explained, to the magnet E, when the pendulum-armature would be attracted thereto and steam admitted to the lower end of the cylinder, driving back the cam abreast of said commutator, where the steam would be cut off from the cylinder again; or, should it be desired to change the position of the cross-head from the commutator H abreast of the commutator H^2, contact is made on the switch-board with the point j^2, and the circuit from the battery is directed to the commutator H^2, there being no circuit with the commutator H', and consequently the cam might ride past it without changing the position of the pendulum-armature, so far as its different parts are concerned; or, again, should it be required to change the position of the cross-head and lever from the commutator H^2 to the commutator H, contact would be made upon the switch-board with the point *j*, directing the current to the commutator H, and from thence, in the manner already described, to the electro-magnet E, which thereby attracts the pendulum-armature and admits steam into the lower end of the cylinder, whereby the cross-head and lever are forced upward.

Any number of commutators may be employed in the series, as desired.

The sleeves *i i'* of the bars I I' may be let into the support G, as shown in Fig. 4, so that the escapement-lever may have contact therewith from the under side of the support, though I do not limit myself to this construction. i^{10} represents insulating material between said sleeves.

The cam upon the piston-rod may be engaged with the escapement-levers of the commutators in any suitable manner—as, for instance, it may be provided with an engaging pin, b^3.

What I claim is—

1. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder, of ports to admit steam alternately into the upper and lower ends of said cylinder, a valve to control the admission of steam through said ports provided with a pendulum-armature for operating the same, said armature governed by electro-magnets D E F, substantially as described.

2. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder, of ports to admit steam alternately into the upper and lower ends of said cylinder, a valve to control the admission of steam through said ports provided with a pendulum-operating armature, said armature governed by a series of electro-magnets, said magnets electrically connected with a switch-board, substantially as described.

3. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder, of ports to admit steam alternately into the upper and lower ends of said cylinder, a valve to control the admission of steam through said ports provided with an operating-armature, said armature governed by a series of electro-magnets, said magnets electrically connected with a series of commutators, said commutators electrically connected with a switch-board, and said switch-board electrically connected with a battery, substantially as described.

4. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder and its piston-rod, of a lever connected with the link-motion and with said piston-rod by an intervening cross-head, ports to admit steam alternately into the upper and lower ends of said cylinder, and an electrically-controlled valve to govern the admission of steam through said ports, said lever provided with an elongated slot in which the cross-head travels, substantially as described.

5. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder and its piston-rod, of a lever connected with the link-motion and with said piston-rod, ports to admit steam alternately into the upper and lower ends of said cylinder, a valve to control the admission of steam through said ports, provided with an operating-armature governed by a series of electro-magnets, said magnets electrically connected with a series of commutators, said commutators electrically connected with the switch-board, and a cam connected with the piston-rod or cross-head for operating said commutators, substantially as described.

6. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder and its piston-rod, of a lever connected with the link-motion and with said piston-rod, ports to admit steam alternately into the upper and lower ends of said cylinder, a valve to control the admission of steam through said ports, provided with an operating-armature governed by a series of electro-magnets, said magnets electrically connected with a series of automatic retracting-commutators, said commutators electrically connected with a switch-board, and a cam connected with the piston-rod or cross-head for chang-

ing the current through said commutators as the piston-rod is reciprocated, substantially as described.

7. In an electrical apparatus for controlling a marine engine, the combination of a steam-cylinder having ports for admitting steam into its upper and lower ends, a valve having an armature connected therewith for controlling the passage of steam through said ports, a series of magnets for operating the armature electrically connected with a series of commutators, and through said commutators with a switch-board, the switch of the board permitting the passage of the current through any desired commutator, and a battery electrically connected with said magnets and switch-board, whereby the current may be directed through the switch-board to any desired commutator and through said commutator to the desired magnet, substantially as described.

8. In an electrical apparatus for controlling a marine engine, the combination, with a steam-cylinder and its piston-rod, of a lever connected with said piston-rod for operating the link-motion, ports to admit steam alternately into the upper and lower ends of said cylinder, a valve for controlling the admission of steam through said ports, provided with an operating-armature, a series of electro-magnets for governing said armature, said magnets electrically connected with a series of commutators, said commutators electrically connected with a switch-board, a battery electrically connected with said switch-board and magnets, the construction and arrangement being such that said commutators will be operated as the piston-rod is reciprocated, substantially as described.

9. The combination, with a series of commutators, of a series of magnets and a switch-board electrically connected therewith, said commutators consisting of reciprocatory conducting-bars, said bars provided with sleeves $i\,i'\,i^2\,i^3$ and connectors $i^6\,i^7\,i^8\,i^9$, and a vibratory escapement-lever, and binding-screws severally connected with one of said magnets, all arranged to operate substantially as and in the manner described.

10. A commutator consisting of reciprocatory conducting-bars, said bars provided with sleeves $i\,i'\,i^2\,i^3$ and connectors $i^6\,i^7\,i^8\,i^9$, and a vibratory escapement-lever, and binding-screws severally connected with one of said magnets, all arranged to operate substantially as and in the manner described.

11. In an electrical apparatus for controlling the admission of steam to a steam-cylinder, the combination, with said cylinder, of a valve for controlling the admission of steam thereto, magnets to operate said valve, and a series of commutators to control the circuits to said magnets, substantially as described.

12. In an electrical apparatus for controlling admission of steam to a steam-cylinder, a series of commutators to control the circuit, said commutators operated by the reciprocation of the piston-rod of said cylinder, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

LOUIS M. SANDERS.

Witnesses:
N. S. WRIGHT,
M. B. O'DOGHERTY.