

J. SANGSTER & W. S. GROSVENOR.

ELECTRIC REGULATORS FOR STEAM-ENGINES.

No. 171,869.

Patented Jan. 4, 1876.

Figure 1

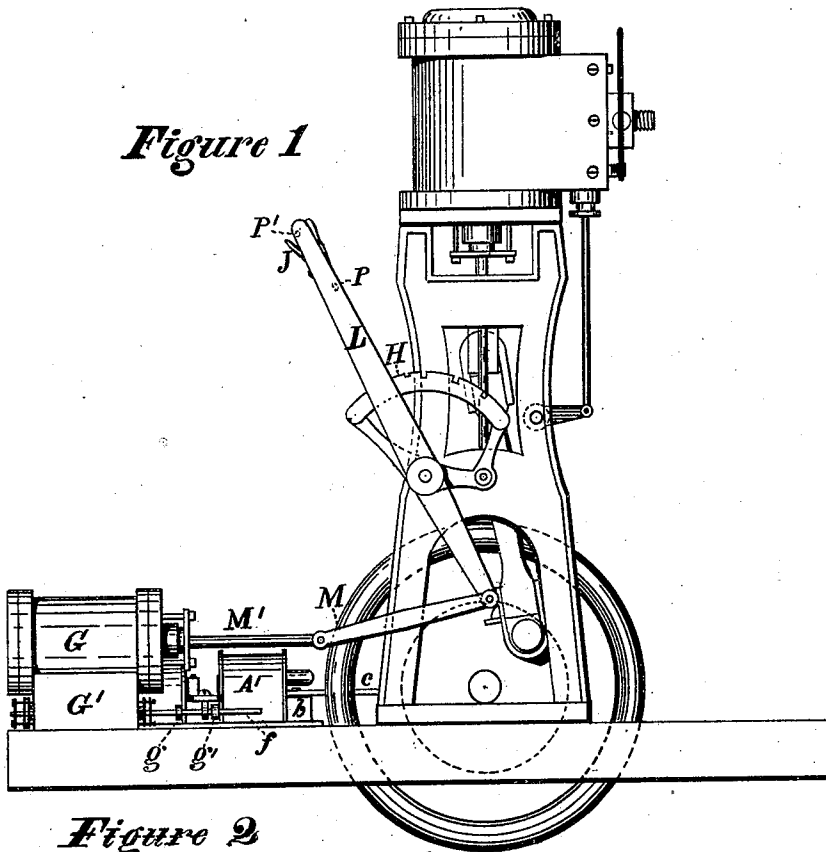
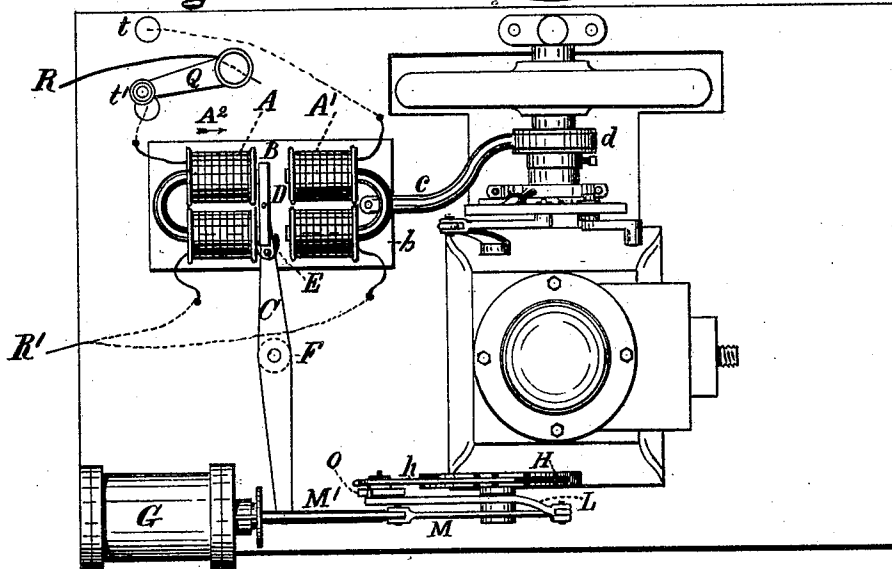


Figure 2



Witnesses,
Amos W. Sangster,
J. P. Liker.

Inventors,
James Sangster,
Wm. S. Grosvenor.

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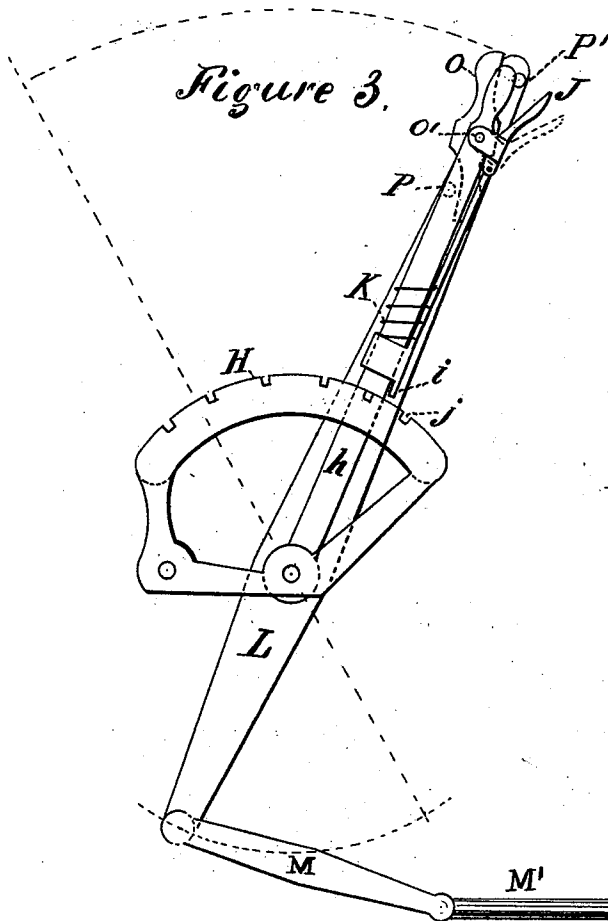
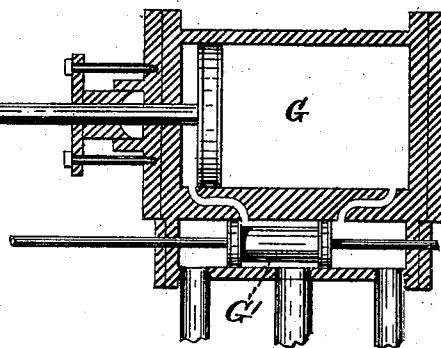
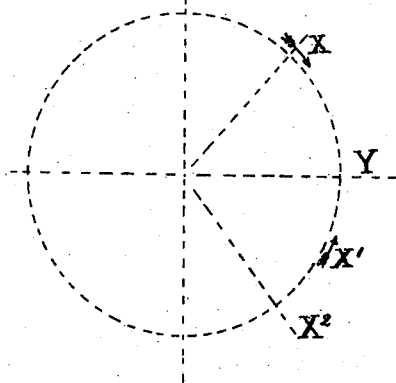


Figure 4.



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J. H. Liker.

Inventors,
James Sangster.
Wm. S. Grosvenor.

UNITED STATES PATENT OFFICE.

JAMES SANGSTER AND WILLIAM S. GROSVENOR, OF BUFFALO, NEW YORK.

IMPROVEMENT IN ELECTRIC REGULATORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **171,869**, dated January 4, 1876; application filed November 27, 1875.

To all whom it may concern:

Be it known that we, JAMES SANGSTER and WILLIAM S. GROSVENOR, both of the city of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Devices for Controlling Steam-Engines or other Machinery from a Distance, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

The object of this invention is to afford the means for moving a valve, or for starting, reversing, or stopping steam or other engines from a distance, and so operating and controlling their movements as to avoid the danger of catching on the center.

The first part of our invention consists of one or more electro-magnets, having a reciprocating motion by means of a crank and connecting-rod, or other suitable connection with the engine, in combination with a movable armature and throttle or other valve; the arrangement being such that, when an electrical current from a galvanic battery or an electro-magnetic machine is completed with either one of the electro-magnets, the armature is attracted and held in close contact with it, when its movement has brought it close enough for that purpose, and thereby drawn in the direction of its motion, so that by a lever or other connection a valve may be opened or closed in either direction, while the full power of the magnet is obtained by the armature being held in close contact during the entire movement, or until the circuit is broken, the action of one magnet moving the lever or armature in one direction, and the other in the opposite direction. When the electrical circuit is broken, the armature remains inactive, leaving the valve stationary, or nearly so, in the position left by the magnet by which it was moved.

The second part of our invention consists of an eccentric or other equivalent device for producing a reciprocating movement, the electro-magnets and their connections, the armature, and its connecting-levers leading to and for moving the valve, all arranged for joint operation, in combination with a crank for converting a rectilinear reciprocating movement into a rotary movement; the eccentric

being arranged with reference to said crank to time the movements of the electro-magnets, so that when an electric-circuit is completed with either one, the armature will be attracted and the valve moved as required only when the crank has reached such a position in its movement that it will not catch on the center either when stopping or reversing the engine, as will be more clearly hereinafter described.

The third part of our invention consists of the movable electro-magnets, the armature, and its connections, in combination with a valve and auxiliary cylinder, for operating a throttle-valve or for moving a reversing-link.

The fourth part of our invention consists in the combination of the ordinary link-reversing lever with an additional lever and unlocking device for lifting the bolt or catch from the notches in the segment, the arrangement being such that the link may be reversed by the auxiliary cylinder without breaking the parts.

In said drawings, Figure 1 is a side elevation of our invention as applied and arranged for reversing a steam-engine from a distance by operating the link; Fig. 2, a plan or top view of the same; Fig. 3, a section through the auxiliary cylinder for operating the link, also a side elevation of the link-reversing lever and the mechanism for releasing it from the segment before moving it; and Fig. 4 represents a diagram showing the operation of our invention in preventing an engine from catching on the center while reversing or stopping.

A A' represent the electro-magnets. They are arranged upon a slideway, *b*, and receive a reciprocating movement from the engine or other moving machine by means of the connecting-rod *c* and eccentric *d*. The eccentric *d* may be adjusted and fastened or set so that the magnet, which is charged by a connected circuit with a galvanic battery or its equivalent, will, by its motion, reach and attract the armature, and move it just at the moment the engine-crank has reached the point where the momentum of the wheel will carry it past the center when stopping the engine, or at the proper point for reversing when it is arranged for operating a link.

B represents the armature, arranged to vi-

brate on the lever C, to which it is jointed at D; it is prevented from vibrating too far by the plate E. The lever C swings upon the joint F, and is connected with the valve-stem *f* of the cylinder G between the collars *g g'*, so as to leave a little lost motion between them.

H represents a segment forming a part of the ordinary link-motion reversing-gear, (better shown in Fig. 3,) *h* being the usual reversing-lever; *i*, the locking device. J is a hand-lever for lifting it from the notches *j*. K represents a spring for holding it down into said notches when adjusted to the point desired for cutting off; but this part of the apparatus—the reversing-gear of a steam-engine—is so well known that it requires no further description here. L represents an additional reversing-lever, to be used in combination with the reversing-link of a steam-engine, provided with a segment having notches for locking the reversing-lever at various points. The lever L is connected with the auxiliary cylinder G by means of the connecting-rod M and piston-rod M', and with the reversing-lever *h* by means of the additional unlocking device O, which is secured and vibrates on the joint O' on lever *h*. P P' represent two projecting pins or studs on lever L.

It will be readily seen that a movement of the lever L in either direction will first turn the unlocking device O by means of either one of the studs P P', according to the direction it is moved, and then move the reversing-arm *h* without breaking the locking-bolt *i*. Q, in Fig. 2, represents an ordinary switch for changing the current from one electro-magnet to another, or for completing a circuit at either *t t'*. When the switch is connected at *t'* the circuit is complete from one pole of the battery R, through the electro-magnet A, to the other pole of the battery R'. When it is at *t* it forms the same circuit through the electro-magnet A'.

An equivalent to our said invention for accomplishing a similar result would be to give the armature a reciprocating movement like that of the electro-magnets, and arrange a connection with the said magnets, so that they will act when charged, and be carried by the moving armature, the same as the armature is now in moving the valve. The result would be the same; but we prefer the arrangement as described.

The operation of our invention is as follows: For reversing an engine, the eccentric, or other equivalent for moving the electro-magnets, is set so that they will operate the auxiliary cylinder and reverse the link at or about the time the engine-crank, as it advances in the direction of the arrow X, has reached the position shown at Y, Fig. 4, thereby admitting steam on the opposite side of the engine-piston, and forcing the crank in the direction of

the arrow X' with sufficient force to continue its movement past the center. This is effected by completing the circuit of the battery at *t'*, and charging the electro-magnet A, which advances in the direction of the arrow A², Fig. 2, far enough to reach the armature B, and hold it in close contact, so that in its reverse movement it will carry the armature with it and operate the valve G', as before mentioned. As long as the armature is held by the electric current it will partake of the movements of the electro-magnet; but the lost motion between the collars *g g'* admits only enough reverse movement of the valve-stem *f* to allow sufficient steam on the opposite side of the piston in cylinder G to cushion it.

It is obvious that a change of electrical circuit from *t'* to *t* will charge electro-magnet A' and reverse the action. When the electrical current is broken by placing the switch Q midway between *t t'*, the armature B remains stationary, or nearly so, while the magnets A A' continue their movements, alternately moving to and from the armature without acting upon it.

When arranged for stopping an engine the auxiliary cylinder or the lever C can be connected directly with the throttle, or an additional lever, C, or auxiliary cylinder may be used for that purpose.

We claim as our invention—

1. The combination, substantially as specified, of a main steam-engine, an auxiliary steam-engine for controlling the steam-supply valve thereof, an electro-magnet reciprocated by the main engine, the armature, the lever for shifting the valve of the auxiliary engine, and the valve thereof.

2. The combination of the movable electro-magnets A A' and their connections, for forming or breaking a circuit with a battery, with an armature, B, arranged between them upon a movable arm, C, for moving a valve in two directions, substantially as and for the purposes specified.

3. The electro-magnets A or A', in combination with the connecting-rod *c* and eccentric *d*, arranged and adjusted upon an engine-shaft with reference to the position of the crank thereon, so as to time the movements of said electro-magnets, for the purposes described.

4. The electro-magnets A A', armature B, arm C, auxiliary cylinder G and its connections, lever L, provided with studs P P', and unlocking device O, all combined and arranged for joint operation for reversing an engine, as set forth.

JAMES SANGSTER.
WM. S. GROSVENOR.

Witnesses:

AMOS W. SANGSTER,
F. P. STIKER.