(No Model.) 3 Sheets—Sheet 1.

E. P. WARNER.

ELECTRIC ELEVATOR CONTROLLER.

No. 555,136. Patented Feb. 25, 1896.

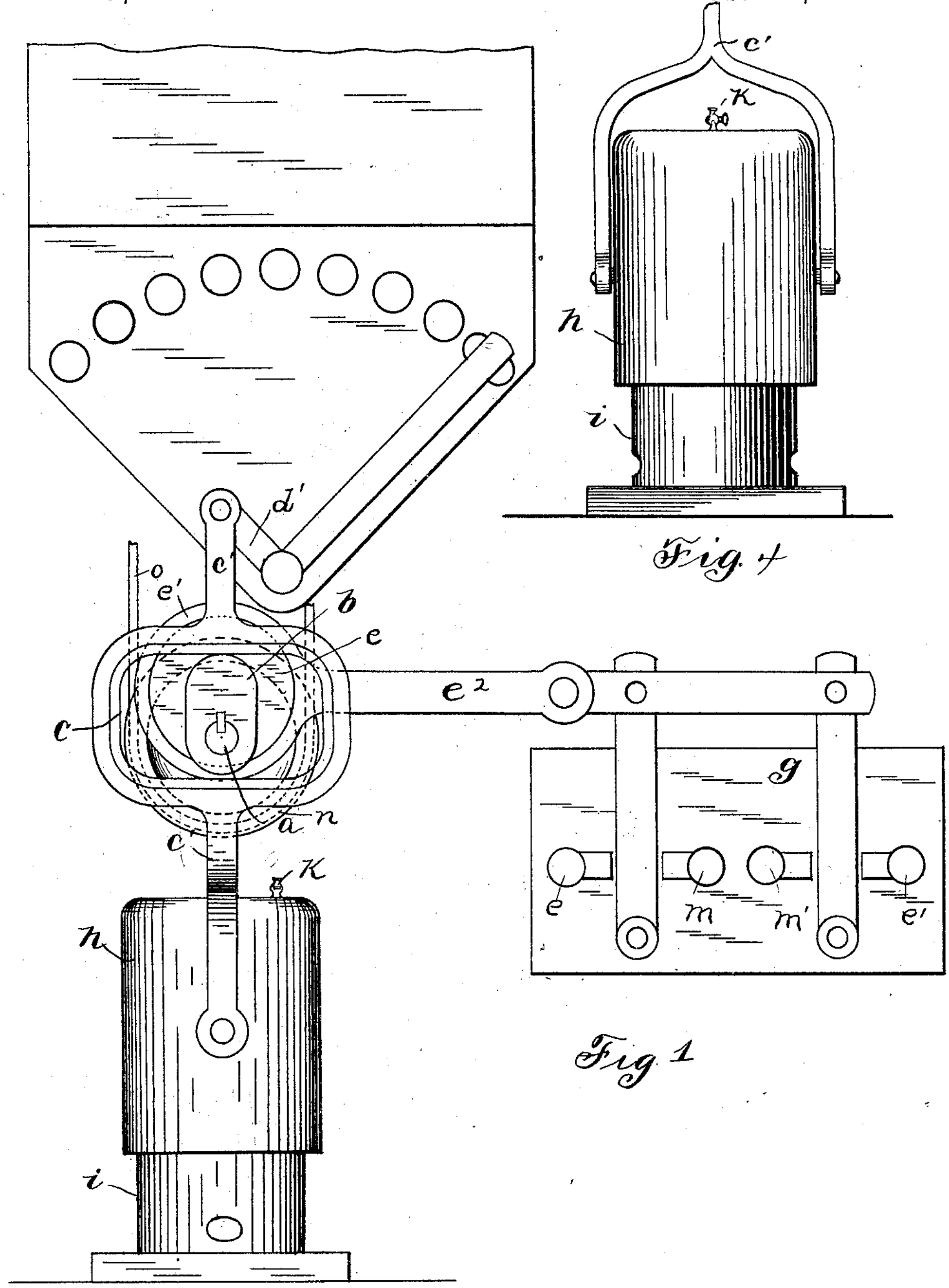

Fig 1

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(No Model.) 3 Sheets—Sheet 2.

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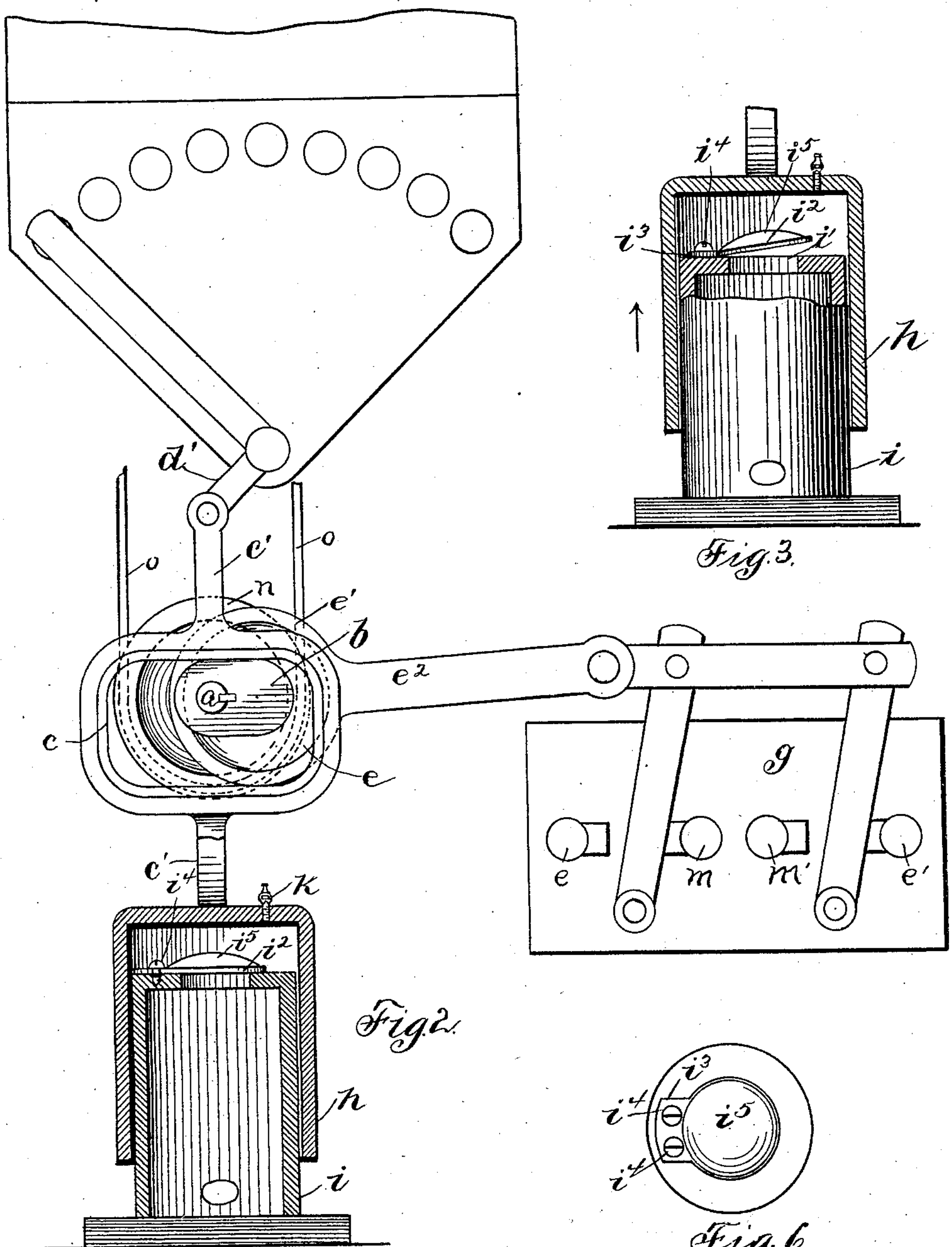

Fig. 3.

Fig. 2.

Fig. 6

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(No Model.) 3 Sheets—Sheet 3.

E. P. WARNER.

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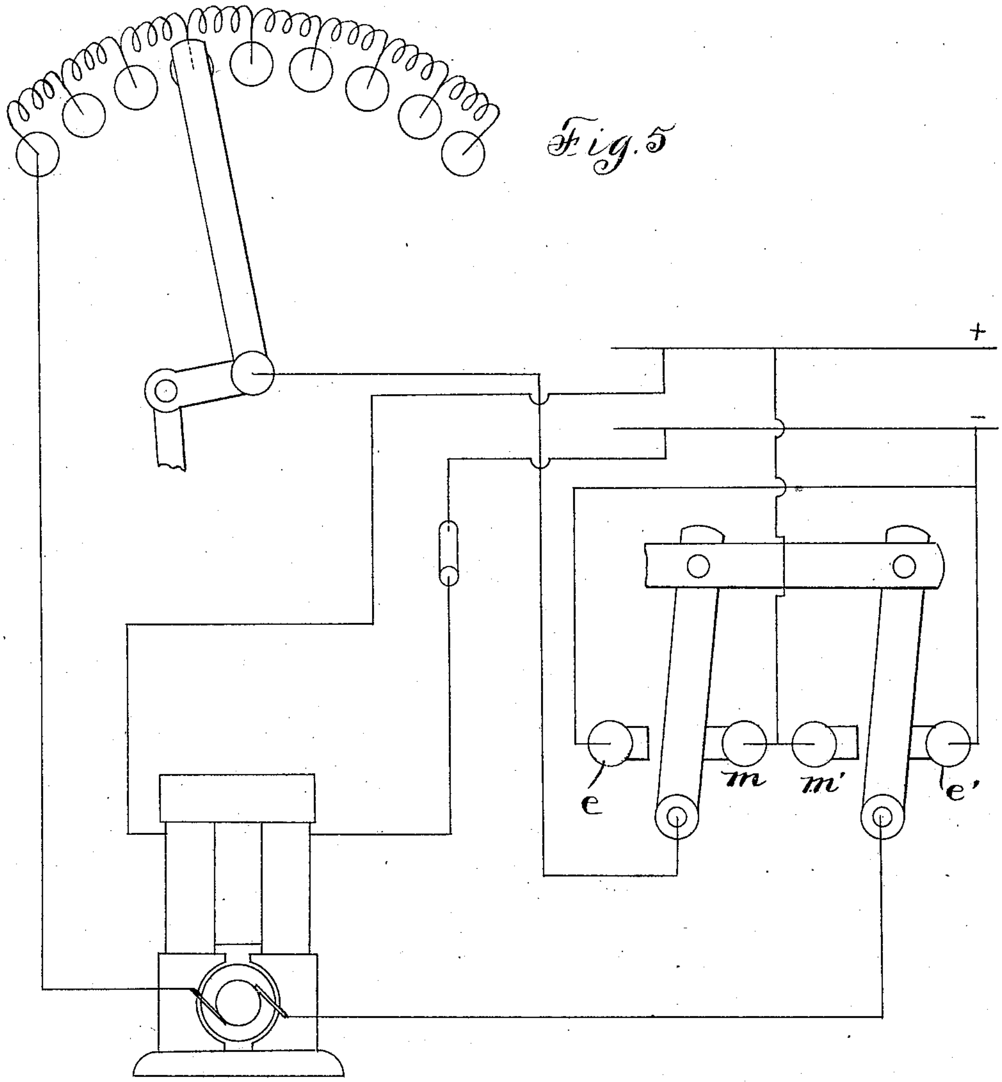

Fig. 5

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UNITED STATES PATENT OFFICE.

ERNEST P. WARNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

ELECTRIC ELEVATOR-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 555,136, dated February 25, 1896.

Application filed October 29, 1892. Serial No. 450,372. (No model.)

To all whom it may concern:

Be it known that I, ERNEST P. WARNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electric Elevator-Controllers, (Case No. 53,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an electric elevator-controller, and its object is to produce a controller by which an electric motor may be controlled from the elevator-car to raise or lower the car or to vary its speed.

My invention consists of an arrangement of cams and cam-guides for operating a reversing-switch and a variable rheostat, together with various details of construction hereinafter described.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is an elevation of the apparatus in the position which it occupies when the elevator-car is at rest. Fig. 2 is a similar view showing the shaft turned through ninety degrees in a right-handed direction, the dash-pot being shown in section. Fig. 3 is a view of the dash-pot, showing the shell in section and a partial sectional view of the plunger, the valve being shown in the position it assumes when the shell is in the act of ascending. Fig. 4 is a view of the dash-pot, showing the means of attaching the plunger to the connecting-rod. Fig. 5 is a diagrammatic view of the electrical connections, a portion of the resistance of the rheostat being shown as cut out. Fig. 6 is a plan view of the valve of the dash-pot.

The shaft a carries a cam b, which is adapted to engage with a cam-guide c carried upon a connecting-rod c'. The connecting-rod c' is attached at its lower end to the shell of the dash-pot, so that the tendency of the connecting-rod is to move to its position of lowest travel, and it will do so, except when restrained from such motion by the action of the cam b upon the cam-guide c. When the cam b occupies such a position that its maximum radius is vertical and extending upward, the connecting-rod c' will be in its highest position. If the cam be turned to the right or left the connecting-rod will descend through the action of the dash-pot, and when the cam shall have moved to a position at right angles to its vertical position the connecting-rod will occupy its position of lowest travel.

To the connecting-rod c', and preferably at the upper end thereof, suitable connections are made with the contact-arm of a rheostat, such that when the connecting-rod occupies its position of highest travel all of the resistance of said rheostat will be cut in, and will be cut out in proportion as the cam b is moved to permit the connecting-rod to descend. When the connecting-rod shall have descended to its lowest position, all of the resistance of said rheostat will have been cut out.

I preferably make the contact-arm in the form of a bell-crank, to the arm d' of which I attach the end of the connecting-rod. As the contact-arm moves over the terminals of the rheostat the connecting-rod will oscillate back and forth, due to the horizontal displacement of the end of the arm d'. It is evident, however, that the contact-arm may be attached to the connecting-rod in a variety of ways.

To the lower end of the connecting-rod c' is attached the shell h of the dash-pot. This shell is in the form of a cylinder closed at the top, and is adapted to slide upon a cylindrical standard or plunger i, whose external diameter is somewhat less than the internal diameter of the shell h. The end of the rod c' is preferably bifurcated and the arms of the fork pivotally attached to the shell h. The plunger i is hollow and is provided at the top with a port i', which is normally closed by a valve i^2. This valve I preferably make of a flexible plate or strip i^3, as of leather or rubber, fastened to one side of the port by screws i^4, and carrying upon its upper face a block i^5 of rigid material. When the plunger h ascends the density of the air within the shell and above the plunger i will be decreased and the pressure of the external air will open the valve i^2 by bending the flexible strip between the screws i^4 and the block i^5, as shown in Fig. 3. When the shell has reached its position of uppermost travel, its interior will be filled with air of atmospheric pressure. As the shell descends the valve

i^2 closes upon its seat and prevents escape of the air through the port i'. The only means of escape for the air is now through the annular passage between the exterior cylindrical surface of the plunger i and the interior cylindrical surface of the shell h, caused by the difference in the external diameter of the plunger and the internal diameter of the shell, or by means of adjustable cock k, which may be placed at any point in the upper portion of the shell. The force causing the shell to descend is its own weight and that of the connecting-rod, and the means for escape of the inclosed air being limited the air will act as a cushion and insure the gradual and steady descent of the shell, and the contact-arm of the rheostat will be moved smoothly over the terminal points. Upon the shaft a is also mounted a cam e, preferably in the form of an eccentric. A connecting-rod e^2 is attached by one end to the eccentric by means of a strap e', and at the other end is suitably connected with a reversing-switch g. The switch g I preferably make in the form of two pivoted levers having their free ends connected by an insulated cross-bar, to the end of which is attached the connecting-rod e^2. Upon either side of each lever is a terminal point with which said levers are adapted to engage, the terminals e e' being connected to one side of the feeding-circuit and the terminals m m' to the other. The levers are connected to the armature-circuit and form the terminals thereof, the circuit being from one lever through the rheostat and armature to the other lever. When the levers occupy an intermediate position, the circuit through the armature will be open, and when they are moved to the right circuit will be closed through the armature in one direction, and when moved to the left it will be closed in the opposite direction.

It will be seen that by rotating the shaft a in either direction the connecting-rod c' will act to cut out the resistance, so that the speed of the motor and consequently of the elevator-car will depend upon the angle that the cam b makes with the vertical. The eccentric e being set upon the shaft so that its maximum radius is perpendicular to the axis of the connecting-rod e^2 when the switch-levers occupy an intermediate position between the terminal points, any motion of the shaft in one direction or the other will act to cause said levers to make contact with one pair of terminals; but if the shaft be rotated in one direction a current will be sent through the armature in a definite direction, and if it be rotated in the other direction the current will traverse the armature in the opposite direction. Thus while rotation of the shaft in either direction will always cause a cutting out of resistance of the rheostat rotation in one direction will cause the current to traverse the armature to cause the same to rotate in a definite direction, while a rotation of the shaft in the opposite direction will reverse the current through the armature to cause the same to revolve in an opposite direction. The cams and connections are so adjusted that when the shaft a is rotated the levers of the switch will make contact with a pair of terminals before the contact-arm of the rheostat leaves the first terminal thereof, so that current may be sent through the armature while all of the resistance of the rheostat is in circuit. As the shaft is further rotated, resistance is cut out while the switch-levers continue to move over the terminal points. By making the cam that actuates the reversing-lever in the form of an eccentric the maximum velocity is imparted to the switch-levers at the time of starting, thus closing the circuit through the armature quickly, while further rotation of the shaft causes a slower motion of the switch-levers over the terminals. This arrangement of the eccentric also insures a quick break of the armature-circuit at the time of stopping.

The elevator-car being at rest at the bottom of the shaft, and the controlling apparatus being in the position shown in Fig. 1, all of the resistance of the rheostat is in circuit with the armature, and the circuit through the armature is open at the reversing-switch. The operator upon the car pulling upon the hand-rope rotates the shaft a, say, to the right. This rotation of the shaft a first moves the switch-levers through a sufficient distance to close the circuit through the armature of the motor to send current through the same in a direction to cause the armature to revolve to hoist the car, but the total resistance of the rheostat being now in circuit with the armature the rate of rotation thereof will be small, so that the speed of the car will be low. If the shaft a be further rotated to the right, resistance will be cut out of the armature-circuit and, supposing the load constant, the rate of rotation of the armature will increase. When the shaft has been turned through about ninety degrees and the shell has completed its descent, all of the resistance of the rheostat will have been thrown out of the armature-circuit and the speed of the car will be a maximum. When the operator desires to stop the car, the shaft is rotated to the left to its original position, the circuit through the armature being thus opened and the car is brought to rest.

When it is desired to descend, the shaft is rotated to the left to close the circuit through the armature of the motor to send current in an opposite direction, whereby the armature will rotate in a direction to lower the car. As the shaft is further rotated resistance is cut out of the armature-circuit to increase the speed of the car. The car is brought to rest by rotating the shaft back to its original position.

In Figs. 1 and 2 the pulley n, mounted rigidly on the shaft a, is adapted to be rotated by the cord o, which is arranged to be within easy reach of the operator upon the car at all times. I do not wish to limit myself to this precise mode of communicating rotary motion to the shaft a from the car, as it is obvious many other means may be employed besides the cord and pulley shown.

I do not deem it necessary to show the mechanical connection between the motor and the elevator-car, as that does not constitute an essential feature of my invention and as any well-known method of making such connection may be employed.

An important feature of my invention is the construction of the rheostat and the connection with the case h of the dash-pot in such a manner that the resistance of the rheostat may be gradually or instantaneously introduced into circuit at the will of the operator, but it can be withdrawn only gradually, the withdrawal being accomplished by the gradual descent by gravity of the case h. The rate of descent of case h may be adjusted as desired by opening or closing the air-cock k. The result of this operation is that when the car is first started, no matter how suddenly the position of the cam b is changed from vertical to horizontal, the motor is not at once called upon to operate the elevator at full speed, but on the contrary the car starts slowly and gradually acquires its full speed, thus avoiding jar, undue strain on cables, and loss of energy. At the same time the car may be gradually slowed down while ascending or descending.

Having described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric elevator-controller, the combination with a shaft, the rotation of which may be controlled by the operator in an elevator-car, of cams mounted upon said shaft, the contact-arm of a rheostat, a reversing-switch, and linkage between said cams and said contact-arm and said switch respectively, whereby the electric motor actuating said elevator-car may be controlled, substantially as described.

2. In a controller for electric elevators, the combination with a shaft, the rotation of which may be controlled by the operator in an elevator-car, of a cam mounted upon said shaft, a rheostat contact-arm, linkage between said cam and said contact-arm, an eccentric mounted upon said shaft, a connecting-rod attached by one end to said eccentric by means of a strap, a reversing-switch and connection between said connecting-rod and said switch, whereby the electric motor actuating said elevator-car may be controlled, substantially as described.

3. In a controller for electric elevators, the combination with a shaft, the rotation of which may be controlled by the operator in an elevator-car, of a cam mounted upon said shaft, a connecting-rod carrying a guide adapted to engage with said cam, a rheostat contact-arm, connection between said contact-arm and said connecting-rod, means for giving to said connecting-rod a tendency to move in a direction to operate the contact-arm, an eccentric carried upon said shaft, a connecting-rod attached at one end to said eccentric by a strap, a reversing-switch, connection between said connecting-rod and said switch, whereby the electric motor actuating said elevator-car may be controlled, substantially as described.

4. The combination with a shaft, the rotation of which may be controlled by the operator in an elevator-car, of a cam mounted upon said shaft, a connecting-rod carrying a guide adapted to engage with said cam, a dash-pot connected to the end of said connecting-rod, a rheostat contact-arm, connection between said arm and the end of said connecting-rod, an eccentric mounted upon said shaft, a connecting-rod attached at one end to said eccentric by a strap, a reversing-switch and connections between said switch and said connecting-rod, whereby the electric motor actuating said elevator-car may be controlled, substantially as described.

5. The combination with the shaft a, the rotation of which may be controlled by the operator in an elevator-car, of a cam b mounted thereon, connecting-rod c', guide c carried thereon, casing h of the dash-pot attached to the end of said rod c', rheostat contact-arm d carrying an arm d', to which is attached the end of rod c', eccentric e mounted upon the shaft a, connecting-rod e^2 attached to said eccentric by straps, and switch g, whereby the electric motor actuating said elevator-car may be controlled, substantially as described.

6. In a mechanism for actuating the contact-arm of a rheostat, the combination with a rotatable shaft, of a cam mounted thereon, a connecting-rod carrying a guide for said cam connected by one end with said contact-arm, a dash-pot connected to said connecting-rod, whereby said rod is given a tendency to move in a direction to operate said contact-arm, substantially as described.

7. In the actuating mechanism of a variable rheostat the combination with a cam, of a connecting-rod adapted to be moved in one direction by said cam and an adjustable dash-pot adapted to regulate the rate of movement of said connecting-rod in the other direction, substantially as described.

8. The combination with a cylindrical standard provided with a port in its upper end in communication with the external air, of a valve adapted to close said port, a plunger in the form of a cylinder open at one end adapted to work upon said standard, the diameter of said standard being somewhat less than the internal diameter of said cylindrical plunger, whereby a limited escape for the inclosed air is provided and a cushion formed to the descent of the plunger, substantially as described.

In witness whereof I hereunto subscribe my name this 8th day of October, A. D. 1892.

ERNEST P. WARNER.

Witnesses:
W. CLYDE JONES,
GEORGE L. CRAGG.