(No Model.) 4 Sheets--Sheet 1.

J. J. HOGAN.

ELECTRIC CURRENT CONTROLLER.

No. 606,012. Patented June 21, 1898.

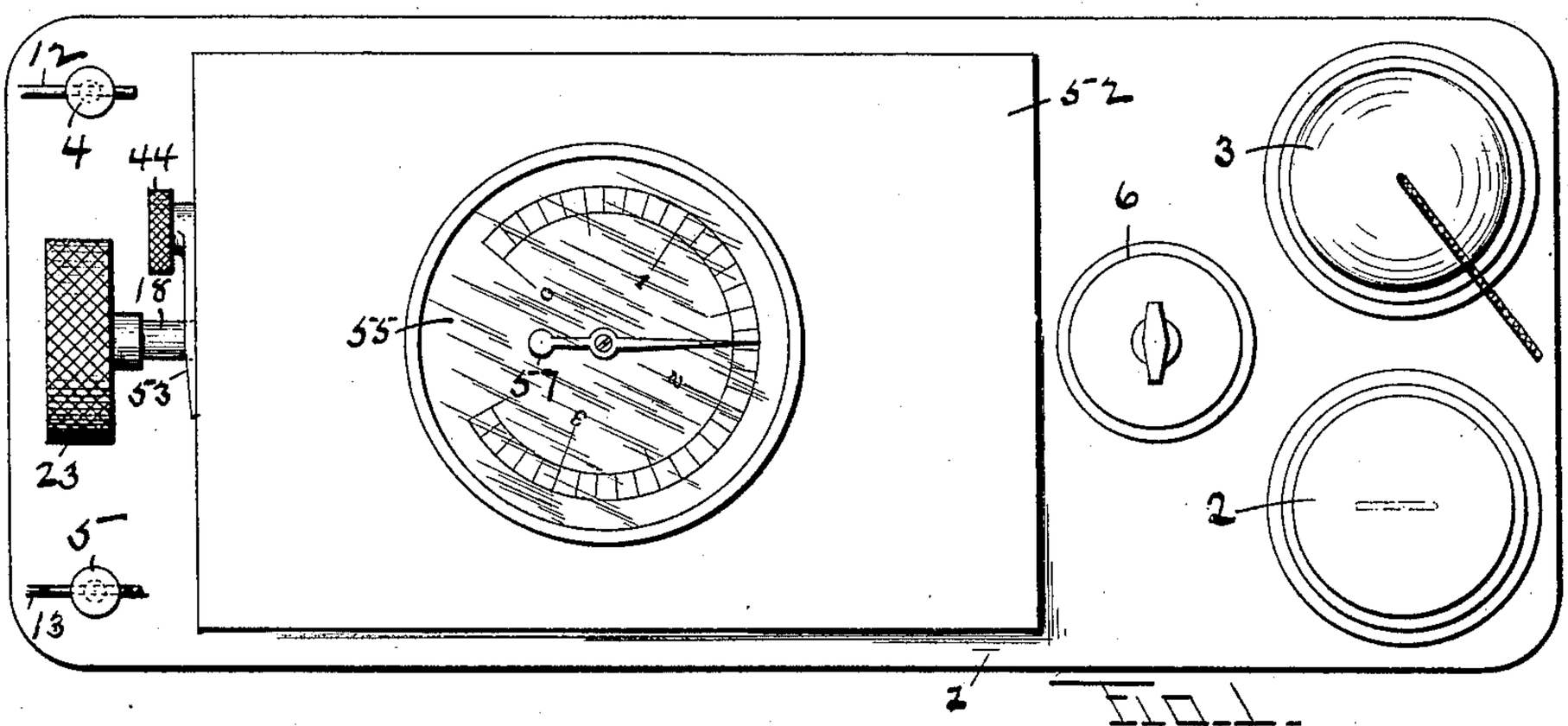

Fig. 1.

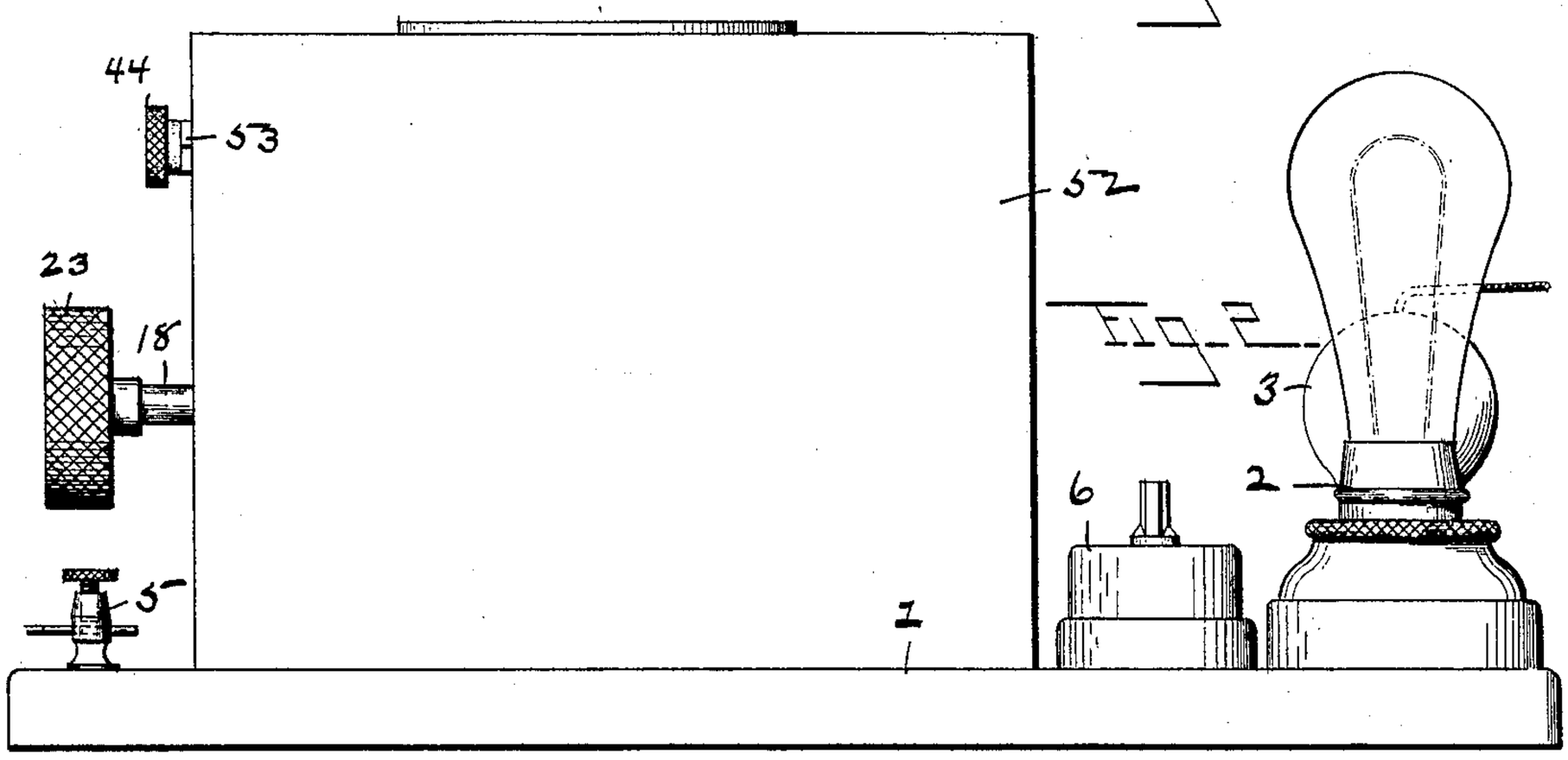

Fig. 2.

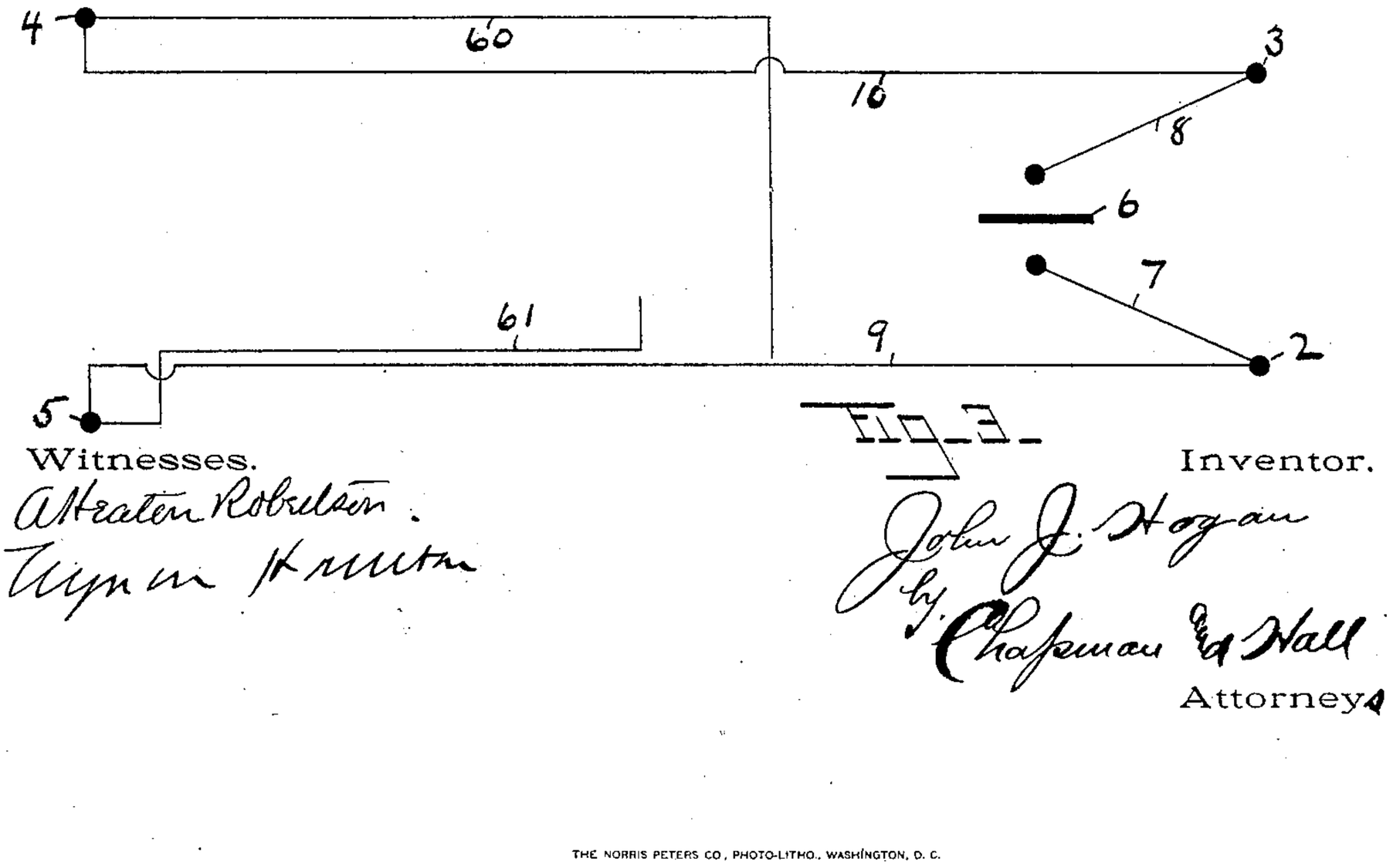

Fig. 3.

Witnesses.
Wheaton Robertson.
Wyman Hamilton

Inventor.
John J. Hogan
by Chapman & Hall
Attorneys

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(No Model.) 4 Sheets—Sheet 2.

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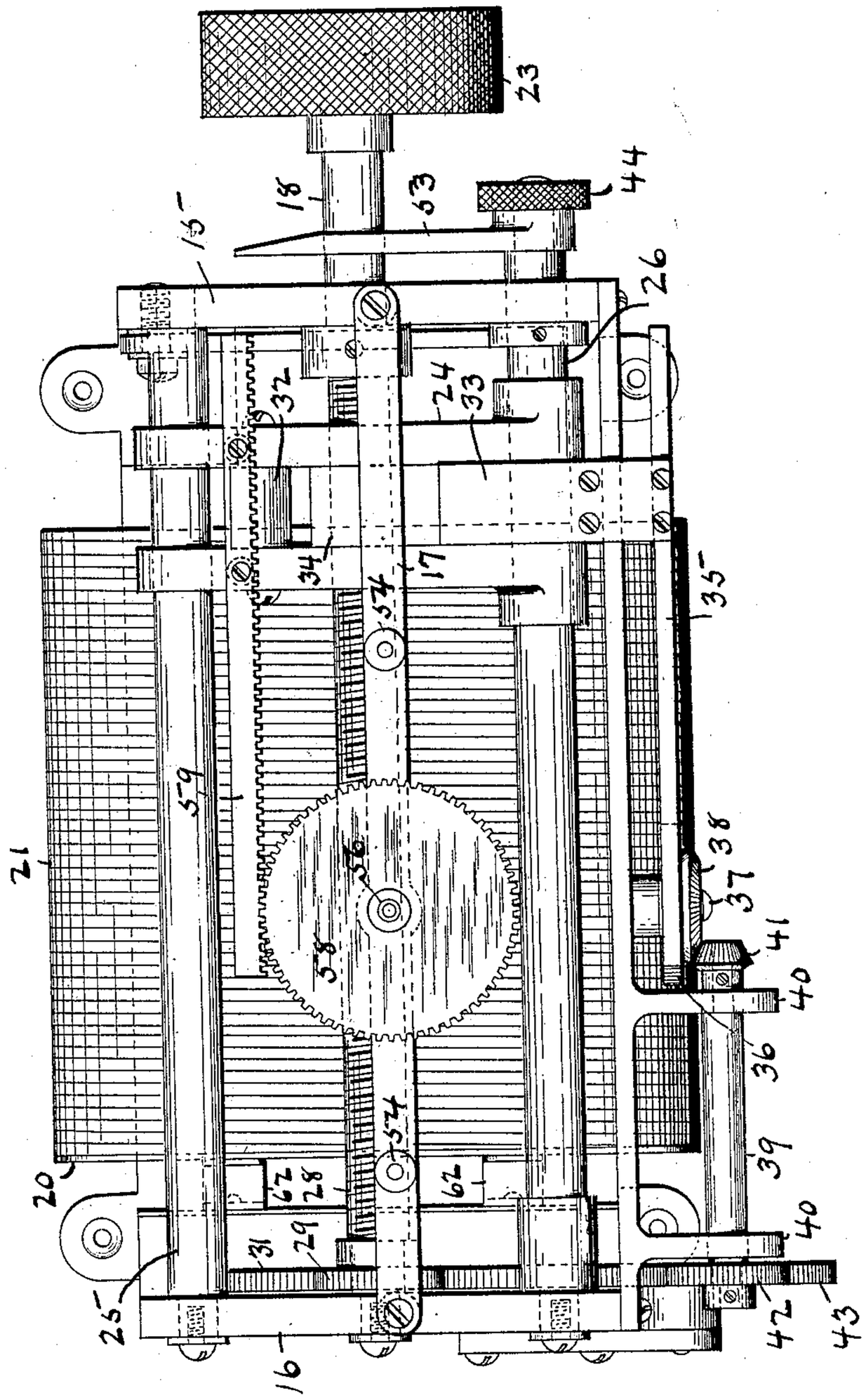
FIG. 4.



Witnesses.
A. Healey Robertson
Lyman Hamilton

Inventor.
John J. Hogan
by Chapman & Hall
Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C

(No Model.) 4 Sheets—Sheet 3.

J. J. HOGAN.

ELECTRIC CURRENT CONTROLLER.

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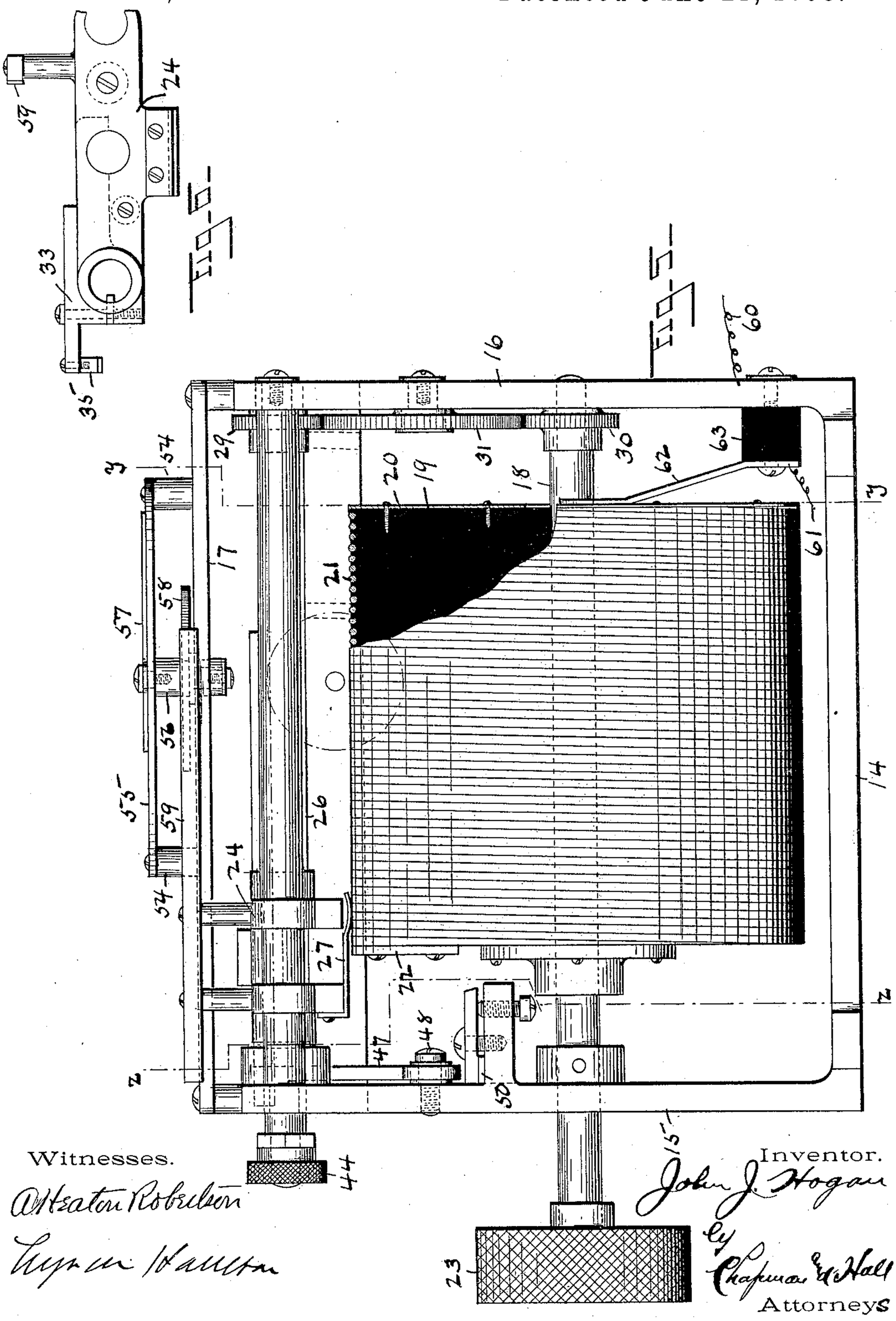

Witnesses.

Wheaton Robertson

Lyman Hamilton

Inventor.

John J. Hogan

by Chapman & Hall

Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 4.

J. J. HOGAN.

ELECTRIC CURRENT CONTROLLER.

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Fig. 8.

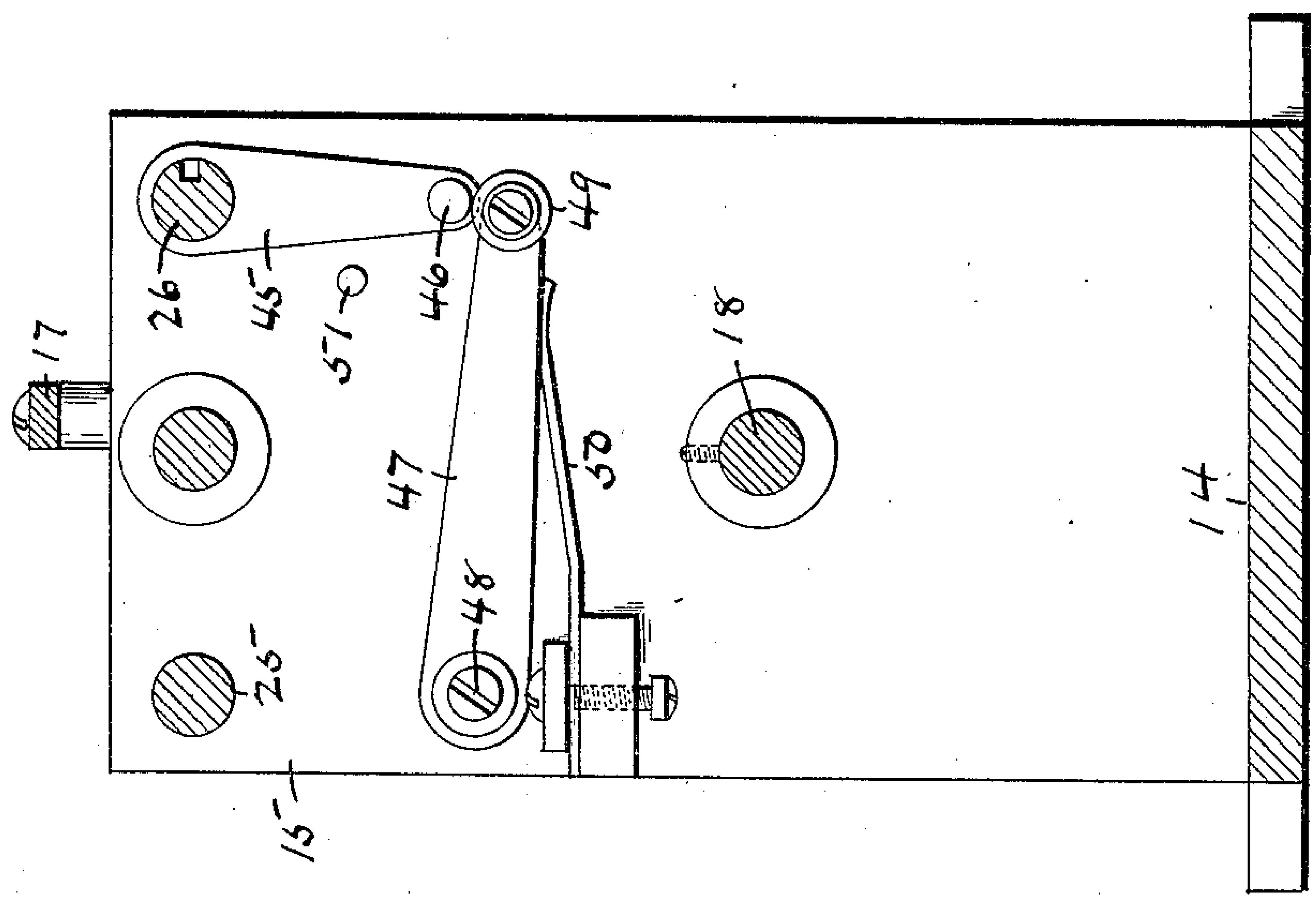
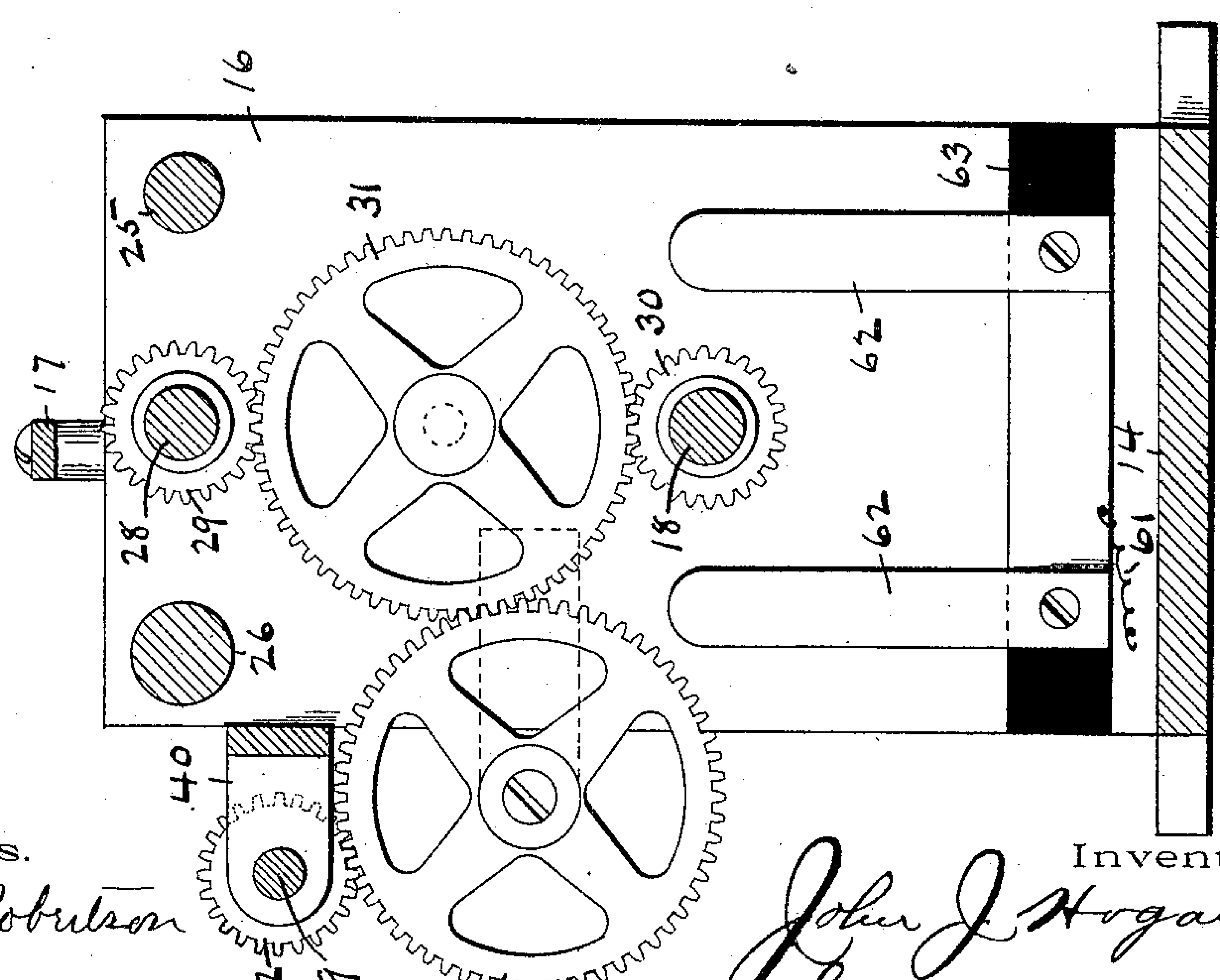


Fig. 7.



Witnesses.

Atheaton Robertson

Lyman Hallton

Inventor.

John J. Hogan

by Chapman and Hall

Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN J. HOGAN, OF NEW HAVEN, CONNECTICUT, ASSIGNOR OF ONE-FOURTH TO THOMAS W. CORBETT, OF SAME PLACE.

ELECTRIC-CURRENT CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 606,012, dated June 21, 1898.

Application filed July 15, 1897. Serial No. 644,616. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. HOGAN, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Current-Controllers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to devices for reducing and controlling the intensity of an electric current with a view to enabling a current of normally high voltage to be applied to various uses in which a low-voltage current is required.

The object of the invention is to provide an apparatus by means of which a high-voltage current of electricity can be reduced to any voltage desired and by which the voltage of the reduced current can be increased and diminished without breaking or interrupting the current in the slightest degree.

A further object is to combine with such means for minutely and uninterruptedly adjusting the intensity of an electric current indicating means for indicating at all times the amount of resistance to which the current is being subjected by the apparatus.

To these ends my invention consists in an apparatus for reducing and governing the intensity of an electric current constructed and operating substantially in the manner hereinafter set forth.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a plan view of an apparatus embodying the invention. Fig. 2 is a side view thereof. Fig. 3 is a diagram illustrating the manner of wiring the apparatus, at the under side of the base of the latter. Fig. 4 is a plan view of the parts within the casing with the latter removed. Fig. 5 is a side view of the same parts. Fig. 6 is an end view of the carriage. Fig. 7 is a cross-section taken at line *y y* of Fig. 4, showing the gear connections between the shafts. Fig. 8 is a cross-section taken at line *z z* of Fig. 4, showing the means for preventing accidental movement of the shaft which controls the feeding movement of the carriage.

The numeral 1 designates the base of the apparatus, composed of any suitable non-conducting material, which base carries at or near one end an incandescent lamp 2 and a plug-socket 3 to receive the usual form of plug by which connection is made with an incandescent-lamp circuit, and at or near its opposite end said base is provided with the binding-posts 4 5. A switch 6 is located on said base near the lamp 2 and socket 3, and by reference to the diagram Fig. 3 it will be seen that one side of said switch is connected by a wire 7 with the lamp 2, and its opposite side is connected by a wire 8 with the socket 3, and also that said lamp is connected by a wire 9 with binding-post 5 and said socket is connected by a wire 10 with binding-post 4. Wires 12 and 13 lead from said binding-posts 4 and 5, respectively, to the point where the current is to be utilized, and the circuit thus established is adapted to be opened and closed by the switch 6 in an obvious manner. By locating the lamp 2 in said circuit I not only reduce the intensity of the current by the amount of resistance offered by said lamp, but also thereby provide a constant indicator to instantly indicate by its incandescence any interruption in or diminution in intensity of the current supplied to the apparatus, as is common in electrical appliances. Between the binding-posts and said lamp and socket is located the mechanism, next to be described, for still further reducing and governing the intensity of the current. Suitably secured upon the base 1 is the frame composed of the bottom 14 and end standards 15 16, preferably cast in one piece, and cross-bar 17, connecting said standards near their upper ends. (See Figs. 4 and 5.) Upon a shaft 18, journaled in said end standards of the frame, is secured a cylinder 19, of hard rubber or other insulating material, to one end of which cylinder is secured a brass or other metallic disk 20, as shown in Fig. 5, and about the circumference of said cylinder is wound a coil of wire 21, preferably of German silver, extending throughout its length. The convolutions of said coil are slightly separated from each other, as shown,

and one end of the coil is connected to the disk 20, while its opposite end is fastened to a plate 22, secured to the cylinder at its opposite end. One end of the shaft 18 projects for a short distance beyond the end of the frame and terminates in a non-conducting hand-wheel 23, by which the shaft and its cylinder may be manually revolved. Above each shaft and cylinder is located a carriage 24, which loosely embraces at its opposite ends a rod 25 and a shaft 26, extending between the end standards, whereby it is free to move upon said rod and shaft in a plane parallel with shaft 18, and said carriage carries a contact-finger 27, having a curved end which rests upon the coil 21 on the cylinder, as shown in Fig. 5, and engages two or more convolutions of said coil. A screw-shaft 28, journaled in the standards between rod 25 and shaft 26, carries a spur-gear 29, which is connected with a similar spur-gear 30 on shaft 18 by an intermediate gear 31, journaled on standard 16, whereby said screw-shaft is caused to revolve in unison with shaft 18, and the pitch of its thread corresponds with the pitch of coil 21 on the cylinder. Said screw-shaft passes through an opening in the carriage 24, which latter is herein shown as being composed of two parallel bars united by a cross-piece 32, Fig. 4. Upon the shaft 26, between the bars of said carriage, is mounted an arm 33, which is connected to the shaft by a spline and groove, (see Fig. 6,) whereby said arm is adapted to move with the carriage longitudinally of said shaft and to have a rocking movement with the shaft independently of the carriage. At one end the arm 33 carries a half-nut 34 (shown by broken lines in Fig. 6) to engage the screw-shaft 28 and cause the latter to impart movement to the carriage, and at its opposite end it carries a rack-bar 35, which is adapted to engage a toothed wheel 36, journaled upon a stud 37 on the frame (see Fig. 4) and having connected with it a bevel-gear 38. A short shaft 39, journaled in brackets 40 on the frame, carries at one end a bevel-gear 41, which meshes with said gear 38, and at its opposite end carries a spur-gear 42, which meshes with an intermediate gear 43, driven by the gear 31. (See Fig. 7.) By means of said shaft and gear connections the toothed wheel 36 is caused to revolve in unison with the operating-shaft 18. By imparting a slight rocking movement in one direction to the shaft 26, which carries the non-conducting thumb-piece 44 for the purpose, the half-nut 34 can be engaged with the screw-shaft 28 and the rack-bar 35 disengaged from the toothed wheel 36, and by a similar movement of said shaft in the opposite direction the rack-bar is engaged with the toothed wheel and the half-nut is disengaged from the screw-shaft. In this manner I provide for two independent feeds of the carriage, both operated from the operating-shaft 18, of which the screw-feed is used to effect an increase or decrease in the voltage of the current by a continuous movement, whereas the rack-and-pinion feed is used principally for shifting the position of the carriage from one point to another of the resistance-coil preparatory to starting the screw-feed into operation, the rack-and-pinion feed causing a considerably faster movement of the carriage relatively to the movement of the operating-shaft 18 than the screw-feed. The shaft 26 has a depending arm 45, (see Fig. 8,) which carries at its lower end a laterally-projecting stud 46, and a lever 47, pivoted at 48 to the frame, carries at its free end a roll 49, while a spring 50, secured at one end to the frame, engages the under side of said lever and retains it in such position that its roll 49 engages the stud 46 to prevent accidental movement of the arm 45 and shaft 26 in both positions of the latter, while at the same time permitting said shaft and arm to be positively rotated in either direction when desired. A stop-pin 51 on the frame also prevents undue movement of the arm 45 in one direction.

A suitable casing 52 incloses the frame and the mechanism supported thereby, and to constantly indicate the position of shaft 26, or, in other words, to indicate which one of the two feeds is in operative engagement with the carriage, said shaft carries a finger or pointer 53 adjacent to its thumb-piece, which gives such indication, in connection with any suitable marks or words on the outer surface of the casing 52.

Upon the cross-bar 17 of the frame are located two posts 54, upon which is supported a dial 55, and a shaft 56, journaled in said cross-bar, carries at its upper end a pointer 57, which overlies said dial, and at its lower end carries the toothed wheel 58, which is engaged by a rack-bar 59 on the carriage 24. Said dial is so graduated relatively to the pitch of the coil 21 that the pointer indicates thereon the voltage of the current being controlled at all times. The casing 52 has a glass-covered opening in its upper side, as shown in Fig. 1, to expose to view said dial and pointer.

A wire 60 connects the binding-post 4 with some part of the frame 14 15 16, and a wire 61 connects the binding-post 5 with two metallic strips or brushes 62, which are mounted upon a non-conducting base 63 on the frame and bear against the disk 20 at the end of the cylinder 19. There is thus established from the main circuit a shunt-circuit extending from one binding-post through the frame, the carriage 24, its contact-finger 27, the resistance-coil, disk 20, and the brushes 62 to the opposite binding-post.

When the carriage 24 is at the extreme limit of its movement toward the right in Fig. 5 and its finger 27 is in contact with the disk 20, there is practically no resistance to the passage of the current through the shunt-circuit, and the voltage of the current in the main circuit through the wires 12 13 is unaffected by the resistance-coil 21. If now shaft 18 be

manually revolved to cause the carriage to move toward the left, the resistance in the shunt-circuit will increase with each convolution of the coil 21 traversed by the finger 27, and the voltage of the current in the main circuit is increased accordingly, there being no break in the circuit, because the advancing movement of the carriage is timed exactly with the pitch of the coil, as before described. Such movement can be hastened or retarded by turning the operating-shaft faster or slower and may be continued until the entire length of the coil is included in the shunt-circuit, thereby securing the maximum voltage which the apparatus is designed to afford.

Whenever it is desired to make a considerable shift of the carriage without waiting for the action of the screw-feed, shaft 26 is moved to its opposite position to throw the rack-and-pinion feed into gear, and the shift is made, after which said shaft is again operated to restore the connection of the screw-feed.

It will be noted that by means of the apparatus thus constructed I not only change the voltage of an electric current without breaking or interrupting the circuit, but that I am also enabled to govern the changes in the voltage to the most minute degree from the highest to the lowest. These capabilities render the apparatus peculiarly applicable for use in dental and surgical operations and other situations in which exact control of the voltage of the current during each instant of the operation is essential.

It is obvious that various modifications in the minor details of construction as herein shown and described can be made within the spirit of the invention.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a current-controller, an operating-shaft, a resistance-coil concentrically mounted upon said shaft and revoluble therewith, a screw-shaft parallel with said operating-shaft and having a thread corresponding in pitch with that of the convolutions of said resistance-coil, a carrier movable in a plane parallel with the axes of said shafts and actuated by the thread of said screw-shaft, a contact-finger mounted upon said carrier and engaging said resistance-coil, and intermediate connections between said operating-shaft and said screw-shaft for causing the latter to revolve in synchronism with the former, substantially as set forth.

2. In a current-controller, the combination with an operating-shaft carrying a resistance-coil, of a carriage movable in a plane parallel with the axis of said shaft and carrying a contact-finger which engages said coil, a screw feeding mechanism and a rack-and-pinion feeding mechanism both of which are actuated by said operating-shaft, and means for interchangeably connecting said carriage to said feeding mechanisms, whereby either mechanism can be utilized to impart movement to the carriage, substantially as set forth.

3. The combination with the operating-shaft carrying the resistance-coil, of the screw-shaft, the toothed wheel, as 36, gear connections between said operating-shaft and said screw-shaft and toothed wheel respectively whereby both of the latter are actuated from the former, the movable carriage carrying a contact-finger which engages said resistance-coil, a half-nut for engaging said screw-shaft and a rack-bar for engaging said toothed wheel, both connected with said carriage, and means for interchangeably engaging said half-nut and said rack-bar with said screw-shaft and toothed wheel respectively, substantially as set forth.

4. In a current-controller, a suitable base having located thereon an incandescent lamp, a plug-socket, two binding-posts, one of which posts is electrically connected to said lamp and the other to said plug-socket, and a switch which opens and closes electrical communication between said lamp and plug-socket, in combination with a suitable frame secured to said base, an operating-shaft journaled on said frame and carrying an insulated resistance-coil, a carriage movable upon said frame in a plane parallel with said shaft and carrying a contact-finger which engages said coil, means for transmitting movement from said shaft to said carriage, and means for electrically connecting the contact-finger on said carriage with one of the binding-posts on the base and for similarly connecting one end of said resistance-coil with the other of said binding-posts, substantially as set forth.

5. The combination with shaft 18 carrying the coil 21, of carriage 24 carrying finger 27 and rack-bar 59, screw-shaft 28 for moving said carriage, dial 55, and shaft 56 carrying pointer 57 and wheel 58 which engages said rack-bar 59, substantially as set forth.

6. The combination with shaft 18 and the cylinder 19 and coil 21 carried thereby, screw-shaft 28, toothed wheel 36, intermediate gear connections substantially as described between said shaft 18 and said screw-shaft and toothed wheel respectively, carriage 24 carrying the finger 27, shaft 26 supporting said carriage at one end of the latter, and arm 33 having a spline-and-groove connection with said shaft 26, said arm carrying at one end the half-nut 34 and at its opposite end the rack-bar 35, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN J. HOGAN.

Witnesses:
J. PETER DEJON,
GEORGE E. HALL.