(No Model.) 2 Sheets—Sheet 1.

A. B. HERRICK.

ELECTRIC CURRENT INDICATOR.

No. 454,270. Patented June 16, 1891.

Fig. 1.

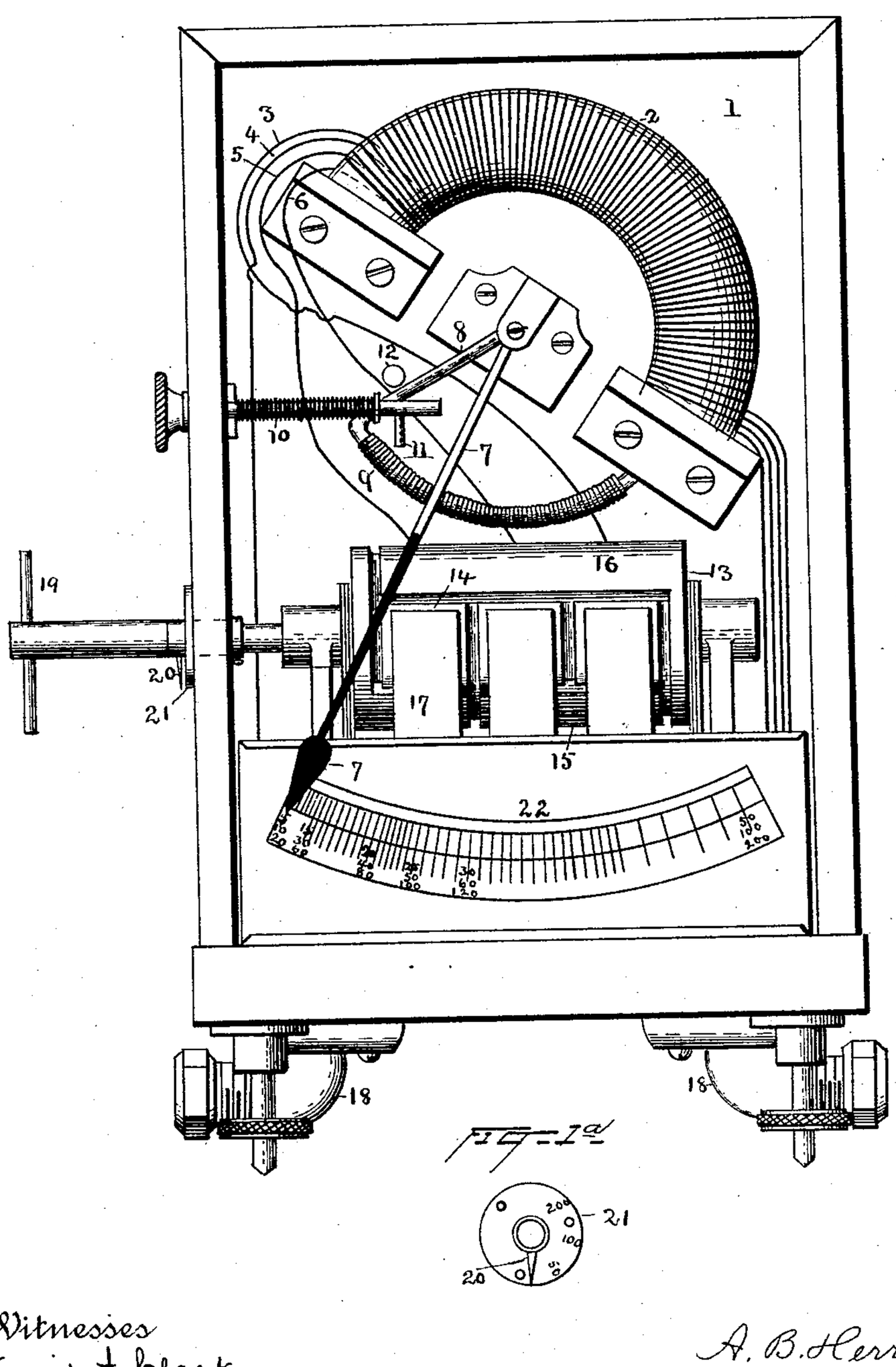


Fig. 1a.

Witnesses
Norris A. Clark.
W. Pyer

Inventor
A. B. Herrick
By his Attorneys Dyer & Seely.

(No Model.) 2 Sheets—Sheet 2.

A. B. HERRICK.

ELECTRIC CURRENT INDICATOR.

No. 454,270. Patented June 16, 1891.

Fig. 2.

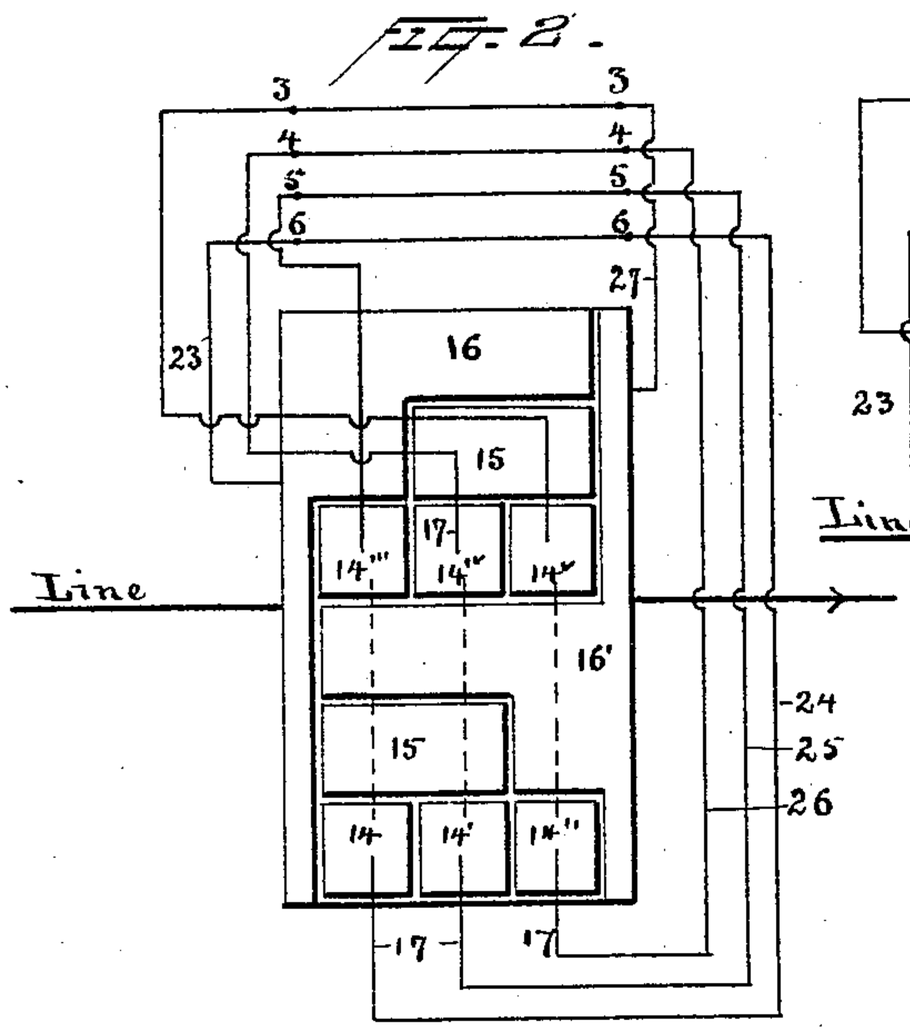


Fig. 4.

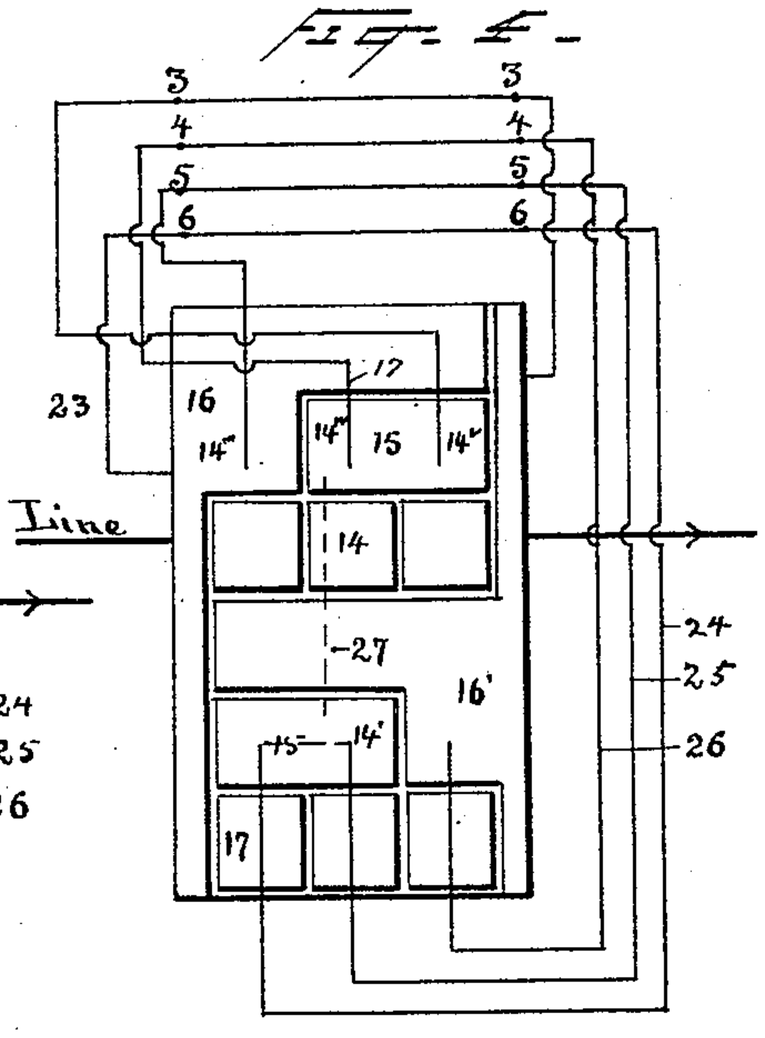


Fig. 3.

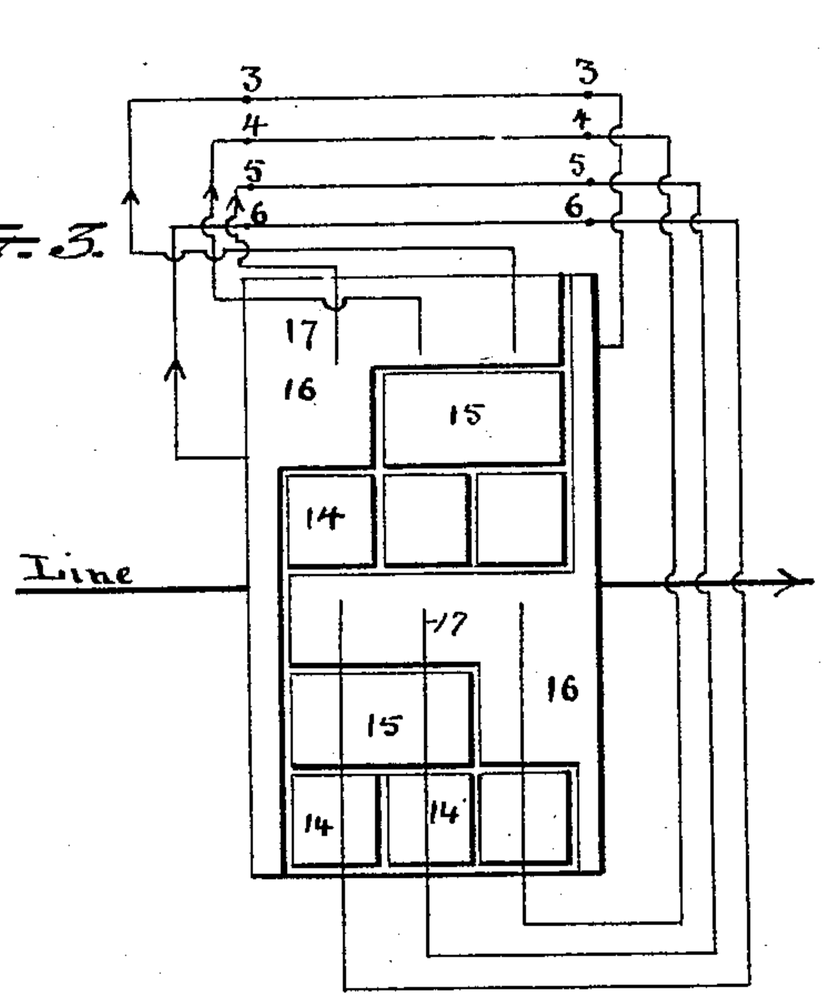
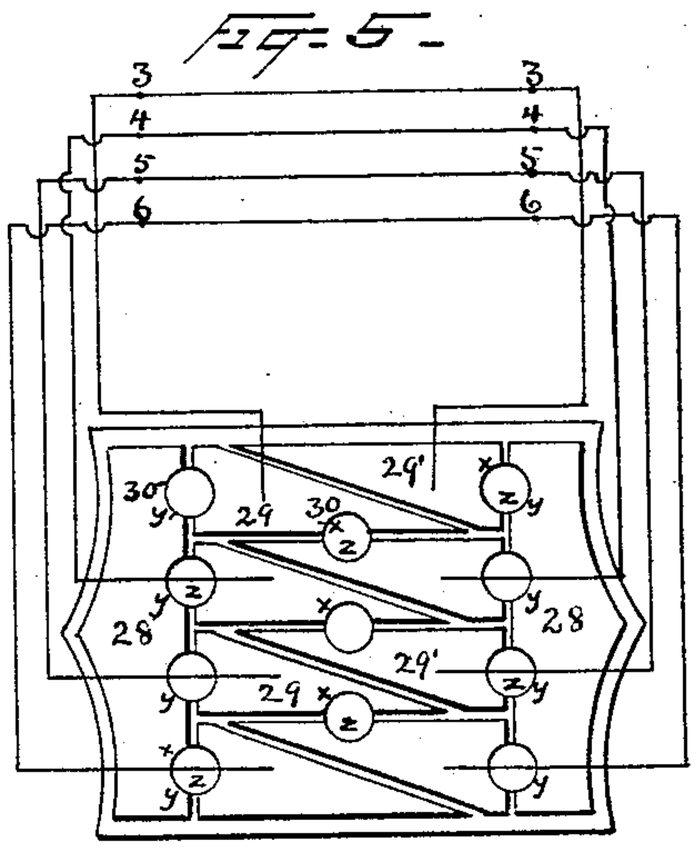


Fig. 5.



Witnesses
Norris A. Clark
W. Byer

Inventor
A. B. Herrick,
By his Attorneys
Dyer & Seely.

UNITED STATES PATENT OFFICE.

ALBERT B. HERRICK, OF NEW YORK, N. Y.

ELECTRIC-CURRENT INDICATOR.

SPECIFICATION forming part of Letters Patent No. 454,270, dated June 16, 1891.

Application filed October 16, 1890. Serial No. 368,331. (No model.)

To all whom it may concern:

Be it known that I, ALBERT B. HERRICK, a citizen of the United States, residing at New York city, in the county and State of New York, have invented a certain new and useful Improvement in Electric-Current Indicators or Ammeters, of which the following is a specification.

My invention relates to devices for measuring electric currents, which are operated by variations in the current measured and which are not dependent on the operation of permanent or other magnets, as is the case in certain forms of ammeters.

The indicator consists, mainly, of the following parts: a hollow solenoid consisting of several conductors, the several conductors being connected to a commutator in such manner that all of said conductors may be connected in series, in multiple series, or in multiple arc, a core for said solenoid connected with the index-hand, and a scale graduated in the novel manner hereinafter described.

The several features and combinations which constitute my invention will be set forth in the several clauses of claim following this description.

In the accompanying drawings, which illustrate the invention, Figure 1 is a front view of an apparatus embodying the improvement. Fig. 1ª is a detail of an indicator or index connected to the commutator. Fig. 2 is a diagrammatic view of the commutator developed, with the wires so connected that all the convolutions of the solenoid are in series. Fig. 3 is a similar view, except that the coils are in multiple arc. Fig. 4 is a similar view in which the coils are in multiple series. Fig. 5 illustrates a modified form of commutator with the wires of the solenoid connected thereto.

Upon a suitable base 1 is mounted the curved solenoid 2, which is composed of several insulated wires wound together on a hollow non-magnetic core. Four such wires are shown in the drawings, and are lettered 3, 4, 5, and 6, respectively.

At the center of the circle of which the solenoid forms a segment is pivoted an index hand or pointer 7, and from this hand extends an arm 8, which carries the curved armature 9, as is well understood with this class of instruments.

10 is a rod which may be turned by means of a thumb-piece on the outside of the instrument-case to bring pin 11 against arm 8, and thus hold it from movement.

12 is a post for limiting the movement of the index-hand toward the left.

Below the solenoid, or in any other convenient position, is located a commutator for controlling the connections of the several coils constituting the solenoid. In Fig. 1 this commutator is shown as a cylinder 13, having conducting-segments 14 15 16, &c., on its surface and co-operating contact-spring 17, adapted to bear against said segments. The segments 16, of which there are two, are connected, respectively, to the two terminals of the circuit, the current in which it is desired to measure, by means of conductors leading to the connectors 18.

19 is any suitable handle for turning the commutator-cylinder.

20 is an indicating device moved over a scale 21 by movement of the commutator-shaft.

Adjacent to the end of the index-hand 7 is placed a scale 22. This scale is correctly calibrated to indicate ampères. The scale is marked in three sections. In the form illustrated the first section reads from 1 to 50, the second section reads from 1 to 100, while the third section reads from 1 to 200. It will be evident from the drawings that several indications may be given by the different sections of this single scale—that is, if it is understood that the reading is to be taken from the first section with the pointer as indicated in the drawings the reading would be five ampères. If it were understood that the reading was to be from the second section, the reading would be ten ampères, while if it was understood that the reading was to be from the third section it would be twenty ampères. By thus arranging the indicating-figures in several conterminous sections—that is, sections terminating in the same radial lines—the use of a long scale, the whole of which must be carefully graduated, is avoided.

In the diagrams the several wires or coils which together constitute the solenoid are lettered 3 3 4 4, &c., to correspond to the numbering in Fig. 1.

Fig. 2, 3 and 4 show the approximate shape and the number and location of the conducting-segments on the commutator-cylin-

der. In Fig. 2 the conducting-springs 17 are shown resting on the six segments 14 14′, &c. This places the coils in series. The circuit may be traced as follows: line, segment 16, wire 23, through coil 6, wire 24, spring 17, to segment 14, to segment 14‴, (said segments, being connected through the body of the cylinder,) to the brush bearing on the latter segment, to coil 5, thence by wire 25 to segment 14′, to 14^{iv}, to coil 4, by wire 26 to segment 14″, to 14^{v}, to coil 3, by wire 27 to the segment 16′, and thence out to line. If the commutator be turned to bring the brushes 17 onto the segment 16, as shown in Fig. 3, the coils will be connected in multiple arc. The circuits are indicated by arrow-heads, and it is thought unnecessary to describe them in detail. If the commutator be turned to bring two of the brushes on each side onto the segments 15 and one brush on each side onto the segment 16 16′, as shown in Fig. 4, the coils will be in multiple series, and the circuit may be traced as follows: line, segment 16, where the current divides, a part going through wire 23, coil 6, wire 24, brush 17, to the lower segment 15. The other branch is through brush 14‴, coil 5, wire 25, brush 14′, to the same segment 15. The united circuit extends through connection 27 to the upper segment 15, where the circuit again divides, one branch being through spring 14^{iv}, coil 4, wire 26, to 16′, and to line. The other branch is brush 14^{v}, coil 3, segment 16′, and out to line. Thus we have two multiple-arc branches in series with two other multiple-arc branches.

In Fig. 5 is shown a convenient form of switch for making the several combinations heretofore described. On a suitable insulating-base are mounted conducting end pieces 28 and intermediate insulated conducting-pieces 29, shaped to admit the insertion of conducting-plugs between them, as indicated at 30. The opposite ends of the coils are connected to the pieces 29 29′, as clearly shown. If metal plugs be inserted in the holes marked *x*, the coils will be in series. If the plugs be inserted in the holes marked *y*, the coils will be in multiple arc, and if in the holes marked *z* will be in multiple series.

The operation of the apparatus above described is as follows: If the indicator is to be used with currents of from one to fifty ampères, the commutator is turned until the pointer 20 stands over the point "50" of the commutator indicating device. The contact-springs of the commutator will then rest on segments 14, throwing the coils into series, and persons reading the indications will understand that they are read from the first section of the scale. If the indicator is to be used with currents of from fifty to one hundred ampères, the commutator is turned until the pointer 20 stands over "100," in which position the contact-springs will rest on the segments 15 16 16′, throwing the coils into multiple series. It will be apparent that while the number of turns of wire in the solenoid remains the same this change of connection reduces the resistance one-half and provides a path better adapted to conduct heavy currents than a single wire. With this arrangement of coils, therefore, the current is doubled, so that if the pointer is moved over an arc which in the first section would indicate, say, twenty ampères it must now be read as forty ampères, and so on for the other indications. If the indicator is to be used with currents of more than one hundred ampères, the commutator is turned to bring the pointer 20 over the number "200." All the springs then rest on the segments 16 16′, throwing the coils into multiple arc and reducing the resistance to one-fourth. The current flowing in this arrangement is four times that of the series arrangement, and persons reading the scale will understand that a movement of the index which on the first scale would indicate twenty ampères should be read on the third scale as eighty ampères. The heating effect of current in the solenoid in the several arrangements is practically the same. The principal advantages of this arrangement of coils and form of scale are that a short scale is made capable of use in an indicator adapted for use with either light or heavy currents, and when used with the former the pointer moves over a larger arc on the scale than would be the case were the indications read from a scale of equal length graduated, for example, to indicate as high as two hundred ampères. In that case it would be almost if not quite impossible to read the indications for small variations in current. The order in which the sections of the index-scale are arranged is not material, although that shown is most convenient.

Without limiting myself to the exact details of construction shown and described, what I claim is—

1. In a current-indicator, the combination of a solenoid composed of several coils, a commutator to which said coils are connected for joining the coils in series or in other relation at will, an indicating device controlled by the coil, and a scale marked in sections, the divisions of each section indicating one-half the number of units indicated by a like division on the following section, substantially as described.

2. In a current-indicator, the combination of a solenoid composed of several coils, a commutator to which said coils are connected for joining the coils in series or in other relations at will, an indicating device controlled by the solenoid, and a scale marked in sections, the indication of each section being appropriate for one arrangement of the coils, substantially as described.

3. In a current-indicator, the combination of a solenoid composed of four coils wound together, a commutator to which said coils are connected for joining the coils in series, multiple series, or multiple arc at will, a pointer controlled by said solenoid, and a

scale marked in three equal conterminous sections, the subdivisions of the first scale-section indicating one-half that of the second section and one-fourth that of the third section, whereby the indicator may be used for light or heavy currents, substantially as described.

4. In a current-indicator, the combination of several wires wound to form a single hollow solenoid, a rotatable commutator having several sections and co-operating springs to which the several coils are connected, the commutator-sections being so connected and arranged that in one position the wires of the coil are in series, in another position in a multiple series, and in a third position in multiple arc, an indicating-pointer controlled by the solenoid, and a scale having several conterminous sections, the indications of which are suitable to the several arrangements of coils, substantially as described.

This specification signed and witnessed this 13th day of October, 1890.

ALBERT B. HERRICK.

Witnesses:

I. SHALER HODGES,

JOHN SAXELBY COBB.