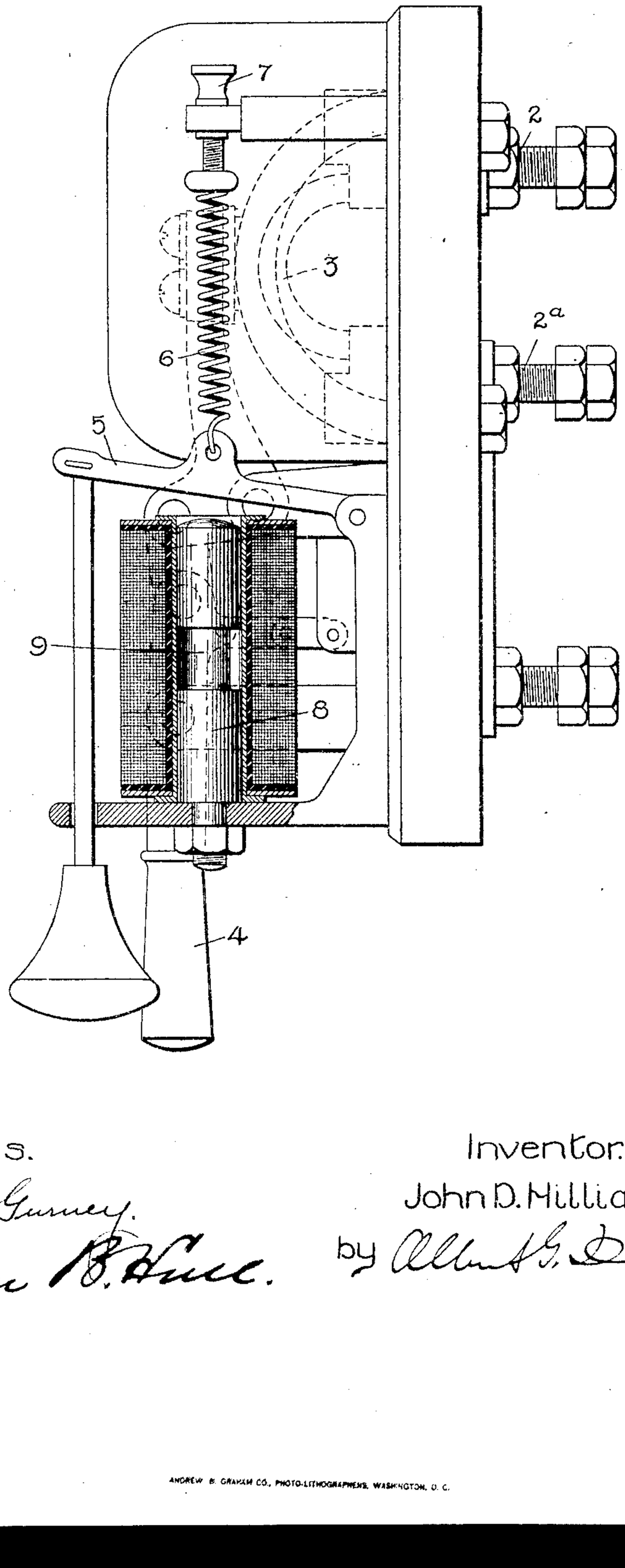
No. 803,825. PATENTED NOV. 7, 1905.

J. D. HILLIARD, JR.

TRIP COIL FOR CIRCUIT BREAKERS.

APPLICATION FILED FEB. 13, 1902.



Witnesses.

Erving P. Gurney.

Benjamin B. Lucas.

Inventor:

John D. Hilliard Jr.

by Allen G. Davis.

Atty.

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN D. HILLIARD, JR., OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TRIP-COIL FOR CIRCUIT-BREAKERS.

No. 803,825. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed February 13, 1902. Serial No. 93,843.

To all whom it may concern:

Be it known that I, JOHN D. HILLIARD, Jr., a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Trip-Coils for Circuit-Breakers, of which the following is a specification.

In calibrating circuit-breakers it is difficult to give them as wide a range of calibration as is desirable. Commonly the range of calibration is controlled by change of adjustment of a retractile spring and if pushed too far is apt to exceed the elastic limit of the spring, in which case the circuit-breaker becomes unreliable in its tripping-point. In other cases the tripping-point is determined by adjustment of the air-gap between the armature and the core of the trip-coil; but this plan also does not admit of as wide a range as desirable.

It is the object of my invention to provide a trip-coil which will increase the range of calibration.

I carry out the invention by providing means for varying the characteristic of the saturation-curve while retaining the same retractile agent and the same air-gap, thereby varying the tripping-point by changing the slope of the saturation-curve. I effect this result by providing a constriction in the iron which constitutes the core of the trip-coil, so that for low tripping-currents the iron in this constriction may be sufficiently beneath the saturation-point to insure prompt and sensitive operation, and for larger currents the saturation-point of the constriction may be reached and the total reluctance of the magnetic circuit thereby changed, thus reducing the slope of the saturation-curve, and thereby extending the range of current variation for a given value of retractile force. The aggregate effect of this constriction is to yield a saturation-curve which for low-current values is almost perpendicular and for high-current values has a slope falling off nearly to horizontal. By means of the constriction in the core the tripping-point for the switch or circuit-breaker is not changed for low values of current, since this point will remain the same up to a value of current which saturates the constricted portion. After such a point of saturation is reached, however, there is, in effect, added to the magnetic circuit an additional air-gap, since all additional flux beyond the point of saturation must leap the gap across the constricted portion 9. Therefore the upper ranges of tripping require considerable increase of current over what would be necessary if the constriction were not formed in the core, and with the same spring and adjusting device therefor the values plotted on the scale-plate for low currents are unchanged and the same scale-plate and same spring and same adjusting device will accommodate a much wider range of current.

The novel features of my invention will be more particularly hereinafter described, and will be definitely indicated in the appended claims.

In the accompanying drawing the figure shows a sectional view of a trip-coil to which my improvements have been added, said coil forming part of a well-known type of circuit-breaker.

1 represents a supporting-board of slate or other fireproof material commonly employed in switches and circuit-breakers, and 2 2^a terminals passing through the board and terminating in contact-faces bridged when the circuit-breaker is closed by a bridging-contact 3. This is controlled by a toggle-operated lever, governed by a setting-handle 4, and the toggle may be tripped by an armature 5, retracted by a helical spring 6. This spring is commonly provided with an adjusting-nut 7, by which the trip-point may be altered. This, however, is found insufficient for covering a wide range of calibration. I greatly extend the range by providing in some portion of the core 8 of the trip-coil a constriction, as indicated at 9, thereby providing a point in the core which will be saturated at a lower current value than the other parts. The effect of this is that for low-tripping values the constriction 9 will have a sufficient carrying capacity to be below its saturation-point when the minimum desired tripping value is reached, and the slope of magnetization at and near the said minimum tripping-point is therefore very steep, effecting a maximum difference of pull for a small change of current, and this is precisely the qualification which effects a prompt and certain tripping action. If, however, the circuit-breaker is to be used with much larger currents, the reluctance of the circuit for the increased current is largely increased, the effect of the constriction being

to somewhat flatten the curve of saturation, whereby the same instrument may accommodate a much greater range of current without changing its calibrating-spring or its adjusting devices than would be the case if the constriction in the core were not made.

Obviously the arrangement herein described for varying the range of the trip-coil may be applied to other devices than circuit-breakers, as, for example, relays or any other type of electromagnetic apparatus in which a large range of operating-current is desirable.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. Means for increasing the calibration range of an automatic switch, consisting of a core carrying the actuating magnetic flux, having a section more easily saturated than the rest of the core.

2. An automatic switch or circuit-breaker containing a calibrating-spring and adjusting device and provided with means for increasing the reluctance of the trip-magnet for large current values and maintaining the reluctance constant for low current values.

In witness whereof I have hereunto set my hand this 11th day of February, 1902.

JOHN D. HILLIARD, JR.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.