

1,281,084.

Patented Oct. 8, 1918.
 3 SHEETS—SHEET 1.

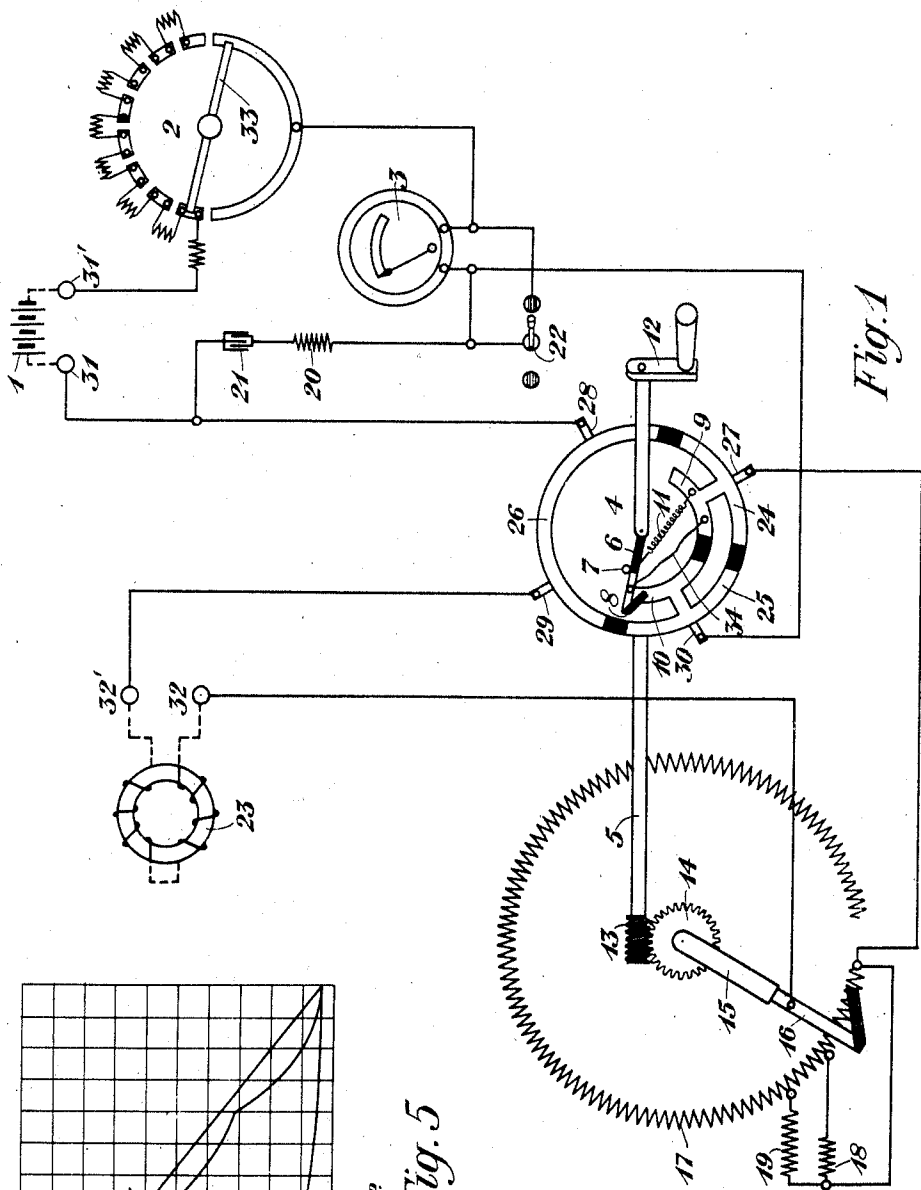
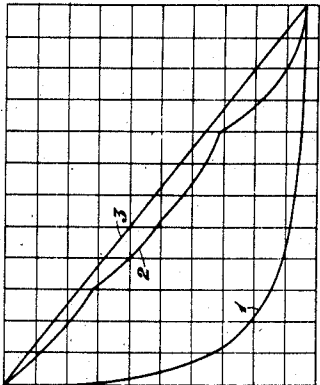


Fig. 1



Time
 Fig. 5

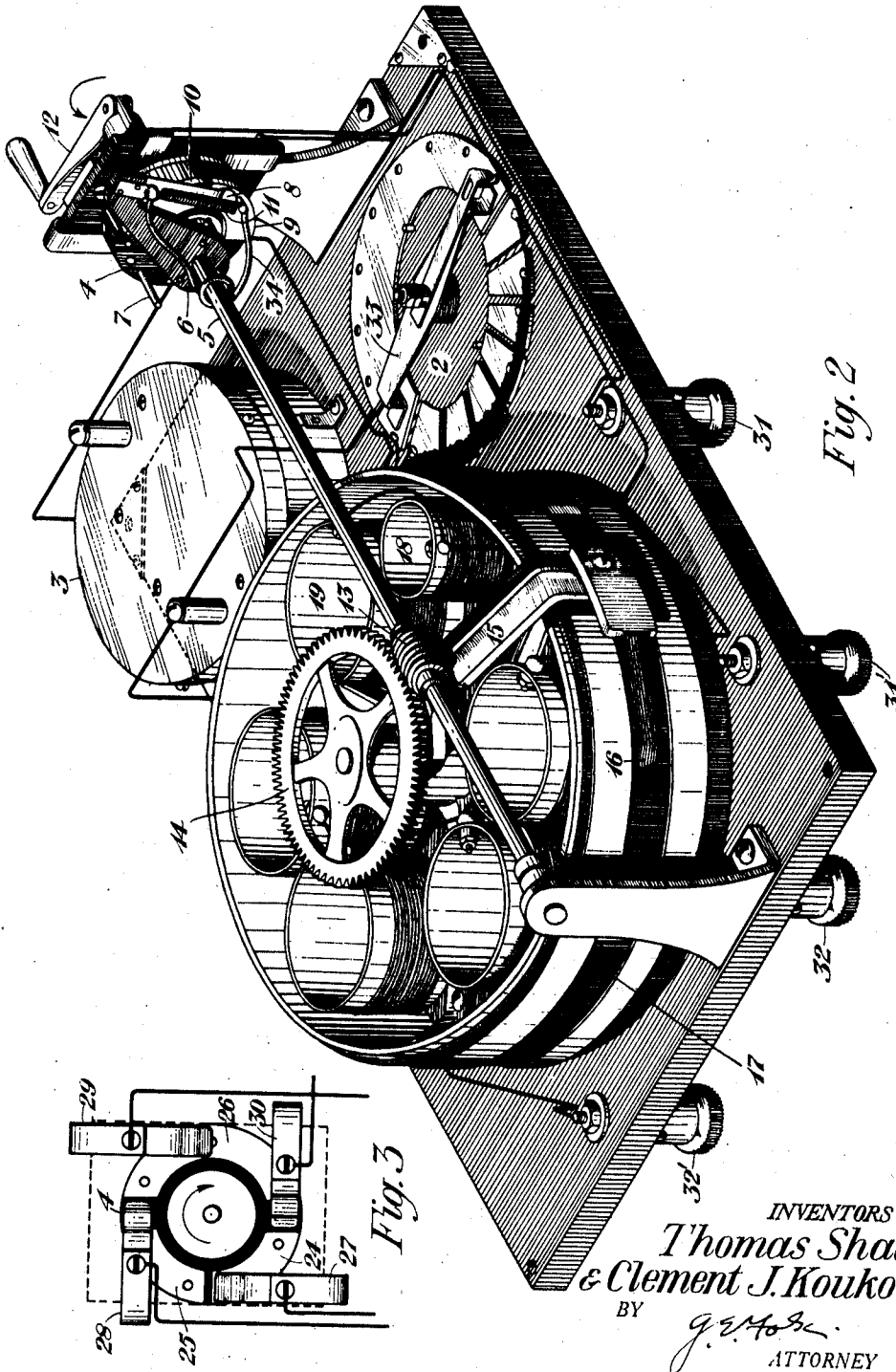
Current

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 DEMAGNETIZING APPARATUS.
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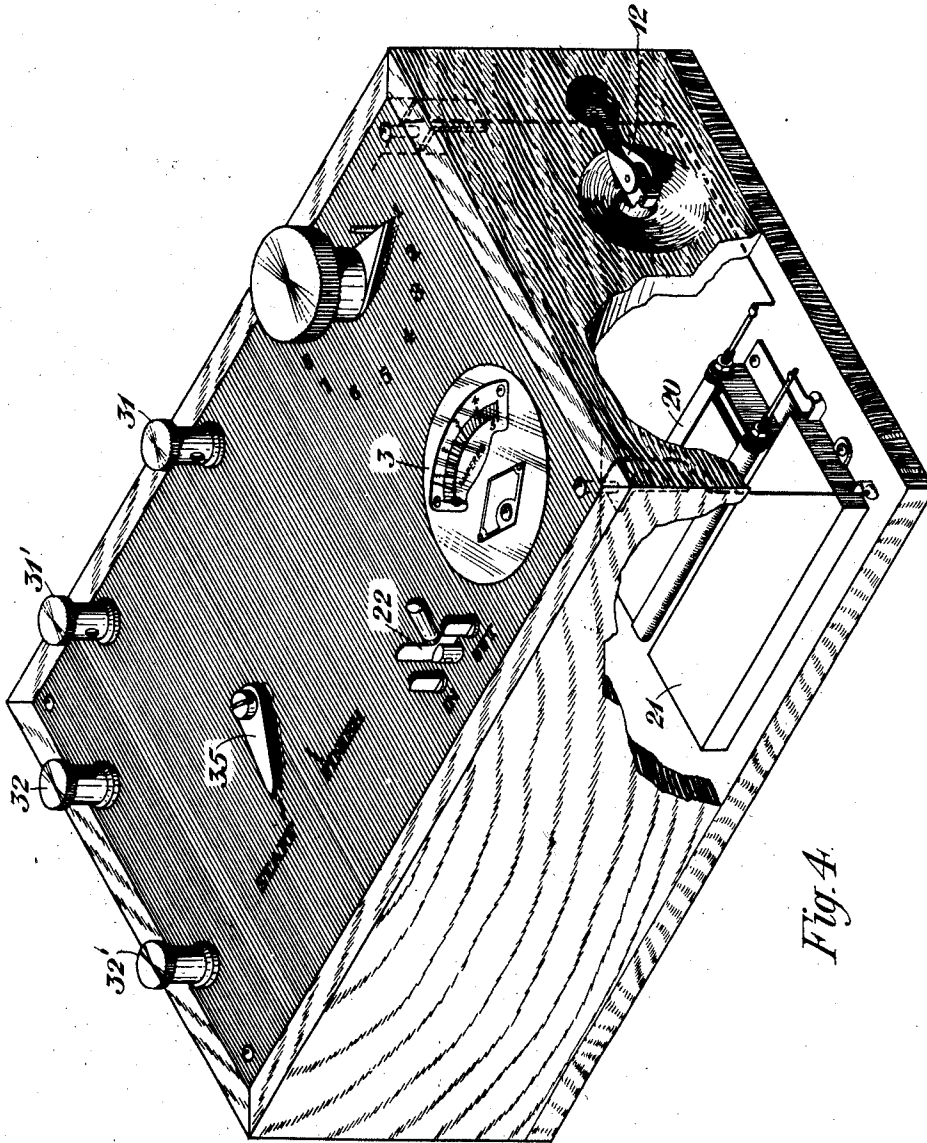


Fig. 4.

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UNITED STATES PATENT OFFICE.

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DEMAGNETIZING APPARATUS.

1,281,084.

Specification of Letters Patent.

Patented Oct. 8, 1918.

Application filed March 4, 1918. Serial No. 220,325.

To all whom it may concern:

Be it known that we, THOMAS SHAW and CLEMENT J. KOUKOL, residing at Hackensack and Elmhurst, respectively, in the counties of Bergen and Queens, respectively, and States of New Jersey and New York, respectively, have invented certain Improvements in Demagnetizing Apparatus, of which the following is a specification.

This invention relates to circuit controlling devices, and more particularly to means for periodically reversing the direction of flow of the current in a circuit and simultaneously reducing the strength of the said current at a substantially uniform rate whereby magnetized iron cores of coils connected in said circuit may be demagnetized.

Heretofore, when it became necessary to demagnetize iron cores of inductance coils, and particularly inductance coils of the type known in telephony as loading coils, it has been customary to connect in series with the coil, having a magnetized core, a portable demagnetizing apparatus consisting of a source of direct current, a rheostat for limiting the initial value of said current, a reversing switch operated usually by the hand or foot of the test man, and a variable resistance whereby the alternating current through said coil may be gradually reduced. The variable resistance, which gradually reduces the current flowing through the said coil, consisted in a resistance wire wound on one or more spools, along which a sliding contactor was moved by hand. In devices of this sort, it was difficult to obtain uniform movement of the contactor along the spools of resistance wire, and, thereby, uniform rate of change of the current in the circuit in which the said variable resistance is connected. Likewise, it was difficult to obtain, by means of a reversing switch operated in the manner described, reversal of current at a uniform rate.

It is the object of this invention to provide mechanism whereby the current flowing through the coil of the core to be demagnetized may be reduced in magnitude at a sub-

stantially uniform rate and simultaneously reversed in direction periodically; also to provide means whereby the circuit will be opened when the power operating the said mechanism has ceased to act.

The nature of the invention will be better understood by referring to the drawing, in which Figure 1 shows diagrammatically the electrical connections between the various parts, Fig. 2 shows in perspective the arrangement of the parts attached to the lower surface of the face plate, Fig. 3 shows parts of the current reversing mechanism which could not be clearly shown in Fig. 2, Fig. 4 shows the arrangement of the apparatus on the face plate and within the case, and Fig. 5 shows current-time curves relating to the improved variable resistance.

In Fig. 1 is represented a source of direct current 1 connected with an adjustable rheostat 2 of a well known type for limiting the initial value of the current. An ammeter 3 is connected in series with the said source and said rheostat to show the initial value of the current, said ammeter being normally short-circuited by switch 22. A drum 4, having a plurality of separately insulated conducting segments attached to the periphery thereof, is loosely mounted upon shaft 5, and is capable of limited rotation upon the said shaft. An arm 6 which is rigidly attached to the said shaft and extends radially therefrom, supports a brush 8, shown herewith in contact with segment 10 which is electrically connected with segment 25. A spring 11, one end of which is attached to said arm and the other end to segment 9, serves to draw the said brush back from segment 10 and on to segment 9, which is electrically connected with segment 24, whenever the power that causes the rotation of said shaft has ceased to act. A pin 7, rigidly fastened to said drum, projects into the path of movement of said arm, and thereby affords means by which the drum is rotated, whenever the shaft is rotated farther than is sufficient to bring the said arm in contact with the said pin.

At the left hand end (as illustrated in Fig. 1) is a worm 13, rigidly connected with shaft 5, and in mesh with gear 14, to which is rigidly attached an arm 15 supporting brush 16 which is in contact with resistance wire 17. The end of the vertical shaft which supports arm 15 protrudes through the face plate of the demagnetizing apparatus as shown in Fig. 4. To this shaft is attached a pointer 35 which indicates the position of the brush on the resistance wire—the words “Start” and “Finish” being stamped on the face plate at the proper points to indicate the beginning and ending of the demagnetizing cycle. Auxiliary resistances 18 and 19 are connected in parallel with sections of resistance wire 17, the functions of which resistance will be more fully described later. Resistance 20, and condenser 21, in series, tend to prevent sparking at the commutator when the current is reversed in the circuit.

Terminals 31 and 31' serve to connect into said circuit a source of direct current which is external to the apparatus, and terminals 32 and 32' serve to connect the coil having a magnetized core which it is desired to demagnetize.

The following description of the mode of operation of this apparatus will more clearly show the nature of the invention.

If it is desired to demagnetize the core of an inductance coil consisting of a single winding, one end of said winding is connected to terminal 32 and the other end to terminal 32'. If the coil consists of a plurality of windings, said windings are so connected that the flux set up in the iron core by the flow of current through all of said windings will be in the same direction and the two free ends of the first and last windings are connected to terminals 32 and 32', respectively. A source of potential capable of producing a direct current equal to the saturation current of the iron core is connected to the terminals 31 and 31'. The controlling handle 12 should then be turned sufficiently to move the indicator 35 to the position on the face plate marked “start” which shows that the brush 16 makes contact with the resistance wire 17, and sufficient pressure should be maintained against said handle to overcome the force of spring 11, thereby holding brush 8 in contact with segment 10, whereby a circuit is closed from one pole of battery 1, rheostat 2, short circuiting switch 22, brush 30, segments 25 and 10, brush 8, flexible conductor 34, segments 9 and 24, brush 27, resistance 17, brush 16, inductance coil 23, brush 29, segment 26, brush 28, to other pole of battery 1. Switch 22 is opened to remove the short circuit around ammeter 3 and rheostat 2 is adjusted by movement of the arm 33 so that

the initial current flowing through the above-traced circuit as shown by said ammeter will be equal to the saturation current of the iron core of the coil under test. When this value is obtained, the short-circuiting switch is again closed, and handle 12 is rotated at a uniformly slow rate of approximately 15 turns per minute thereby rotating shaft 5. The rotation of shaft 5, causing thereby the rotation of brush 16, will gradually increase the resistance of the said circuit by introducing a continuously increasing amount of resistance wire 17 into said circuit, and consequently will gradually reduce the current flowing through said circuit.

When the indicator 35 has moved approximately 120° from the position marked “start”, corresponding to the beginning of the slide wire, the movement of the controlling handle 12 may be gradually accelerated until it reaches a rate of about 4 revolutions per second, which rate is maintained until the indicator reaches the position marked “finish” at which point the demagnetization cycle is completed. It will thus be seen that the current reversing mechanism and the variable resistance for gradually diminishing the strength of said current and also the circuit opening device are all controlled by one device, namely the handle 12, and thereby a more uniform coaction can be obtained than was practicable in the apparatus used heretofore in which each part was operated as a separate unit.

In order to obtain the best results in demagnetizing magnetized cores, it is essential to have the current decrements small and uniform during the early part of the demagnetization cycle, and it is desirable, though not absolutely essential, that this uniformity should continue until the end of the cycle is reached. In the apparatus which has been used heretofore to control the current in the demagnetizing cycle it was impracticable to obtain the desired result. One of the objects of this invention is to provide means whereby the current in the demagnetizing circuit may be reduced at a substantially uniform rate and by small decrements.

Careful consideration will show that if the resistance of the work circuit be varied by uniform increments as a result of the uniform motion of brush 16 along resistance wire 17, which has uniform resistance throughout its length, the current decrements resulting therefrom would be non-uniform; that is, during the early part of the cycle, the current decrements would be very large, during the remainder and by far the greater part of the cycle, the decrements would be very much smaller. This is clearly indicated by curve No. 1 of Fig. 5

which is based upon calculations made upon a resistance wire of uniform cross-section and having uniform resistance throughout its entire length, such as has been used heretofore to control the demagnetizing current. If, however, a composite resistance is used, consisting of a plurality of sections in series, the successive sections having unit resistance values progressively increasing from one end of said composite resistance, and, if one or more of said sections have connected in parallel therewith a plurality of auxiliary resistances such as resistances 18 and 19, it is practicable to obtain substantially uniform current decrements throughout the entire demagnetization cycle, as illustrated by curve No. 2 of Fig. 5. Curve No. 3 of Fig. 5, which is based on a uniform rate of change of current amplitude during the demagnetization cycle, is included in the drawing as a reference standard so as to show more clearly the variation from uniformity of curves No. 1 and No. 2. However, it should be understood that, although the curves shown in Fig. 5 indicate positive values only, the demagnetizing current that flows through the work circuit is alternating in character due to the action of the current reversing mechanism. It will be seen, therefore, that by means of a variable resistance consisting of a plurality of sections of resistance wire in series, the successive sections having unit resistance values progressively increasing from one end of said variable resistance, and one or more of said sections having in parallel therewith a plurality of auxiliary resistances arranged as shown in Fig. 1, or in a similar manner, the current in the demagnetizing circuit may be reduced at a rate more nearly uniform than was practicable to obtain by variable resistances heretofore used.

In a system for demagnetizing the iron core of an inductance coil wherein a direct current is periodically reversed in direction and gradually reduced in magnitude, the invention provides means whereby the current reversing mechanism and the current reducing mechanism may be made to coact simultaneously; means whereby the magnitude of the current may be reduced at a rate more nearly uniform than was heretofore practicable to attain; and means whereby the circuit through said inductance coil may be automatically opened whenever the power operating the demagnetizing apparatus has ceased to act, thereby preventing useless drain upon the source of direct current and avoiding the heating of the apparatus.

Although the invention has been shown as embodied in a particular form, it is evident that it is not restricted to such form, and that it may be embodied in a variety of dif-

ferent forms, without departing from the spirit and scope of the claims hereof.

What is claimed is:

1. In a demagnetizing apparatus, the combination of a source of direct current, adjustable means for regulating the initial magnitude of said current, means for reversing periodically the direction of said current, and means whereby the magnitude of said periodically reversed current may be uniformly varied.

2. In a demagnetizing apparatus, the combination of a source of direct current, adjustable means for regulating the initial magnitude of said current, means for indicating the initial magnitude of the said current, means for reversing periodically the direction of said current, and means whereby the magnitude of said periodically reversed current may be uniformly varied.

3. In a demagnetizing apparatus, the combination of a source of direct current, adjustable means for regulating the initial magnitude of said current, means for reversing periodically the direction of said current, means for gradually reducing the magnitude of said current, and means whereby said current-reversing means and said current-reducing means may be made to coact simultaneously.

4. In a demagnetizing apparatus, the combination of a source of direct current, means for regulating the initial magnitude of said current, means for reversing periodically the direction of said current, said means including a commutator, brushes, means for rotating said commutator, and a mechanism whereby the circuit through said current reversing means may be opened when pressure applied to said rotating means has been released.

5. In a demagnetizing apparatus, the combination of a source of direct current, means for regulating the initial magnitude of said current, means for reversing periodically the direction of said current, a translating device, and means for reducing uniformly the magnitude of said current said means consisting of a plurality of sections of resistance wire connected in series, each successive section having a different unit resistance value, said values successively increasing from one end of said means, and a movable brush in contact therewith whereby the magnitude of the said current may be varied at a substantially uniform rate.

6. The combination with a source of alternating current of a translating device, and a variable resistance, said resistance consisting of a plurality of sections of resistance wire connected in series, each successive section having a different unit resistance value, said values successively increasing

from one end of said means, a plurality of resistances connected in parallel with one or more of said sections and a movable brush in contact therewith whereby the magnitude
5 of the said current may be varied at a substantially uniform rate.

7. The combination with a source of direct current, of a work circuit, means for periodically reversing the direction of the
10 current in the said work circuit, means for

operating said current reversing means and means connected with said operating means whereby said work circuit is opened when said operating means become idle.

In testimony whereof we have signed our
names to this specification this first day of
March, 1918.

THOMAS SHAW.
CLEMENT J. KOUKOL.