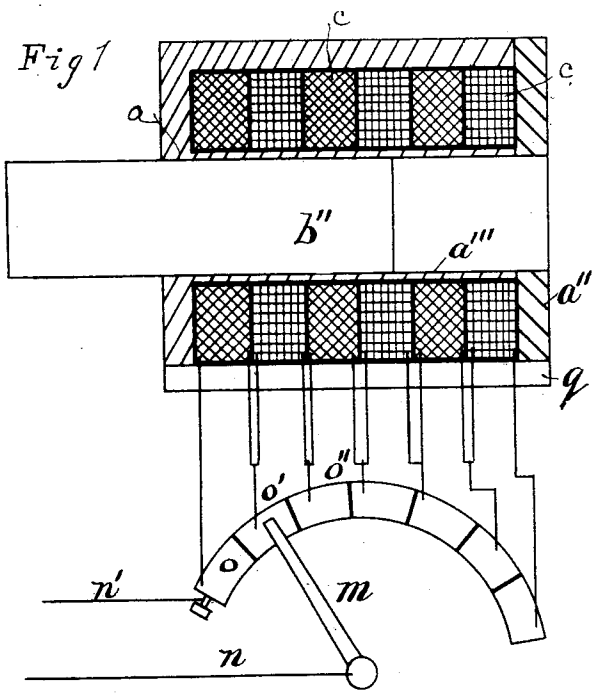
(No Model.) 3 Sheets—Sheet 1.

L. GUTMANN.

CHOKING ELECTRO MAGNET.

No. 424,606. Patented Apr. 1, 1890.

Fig 1



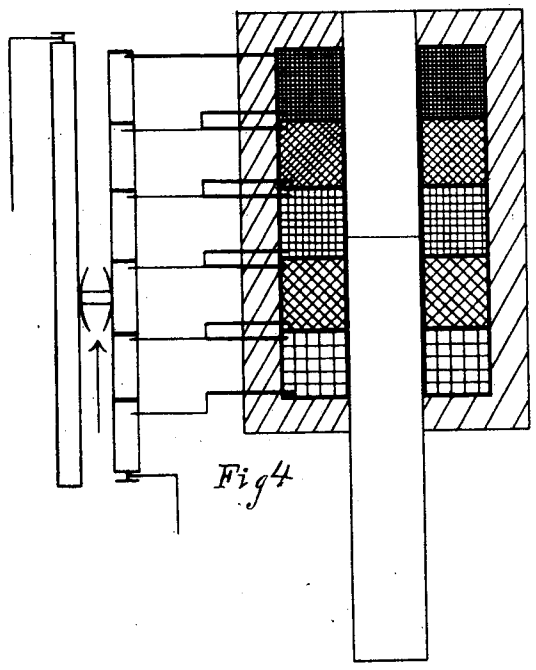


Fig 4

Attest
B. Newman
George A. Murray

Inventor
Ludwig Gutmann
By his Attorney
Edward P. Thompson

(No Model.) 3 Sheets—Sheet 2.

L. GUTMANN.

CHOKING ELECTRO MAGNET.

No. 424,606. Patented Apr. 1, 1890.

Fig. 3.

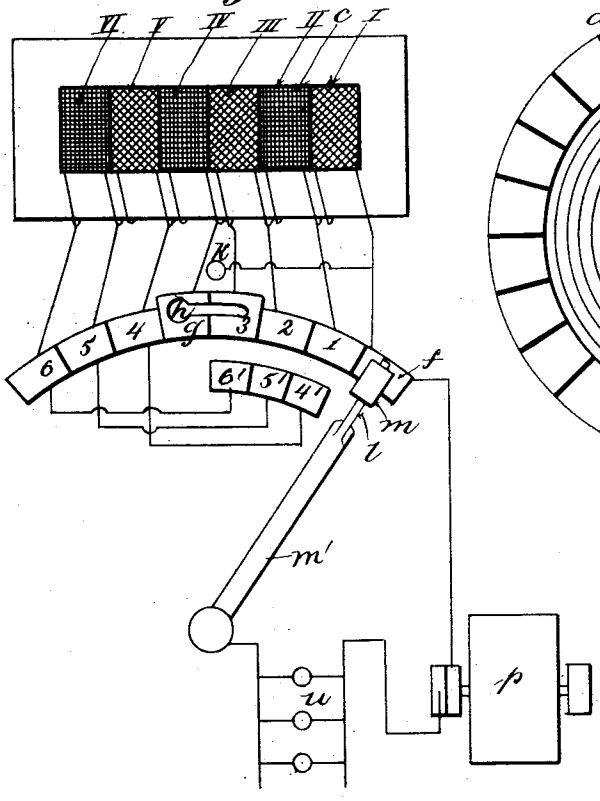
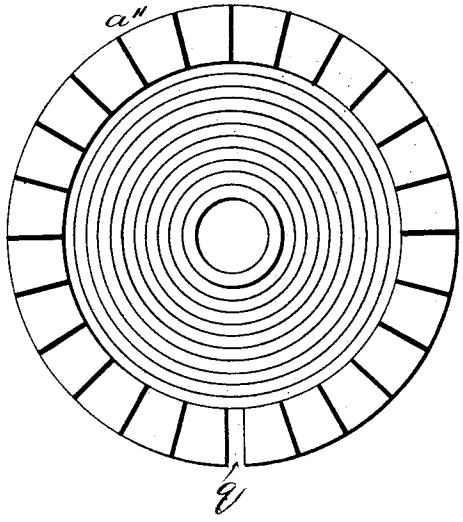


Fig. 2.



Witnesses:
D. W. Gardner
Nellie L. Pope

Inventor:
Ludwig Gutmann,
By his Attorney,
Edward P. Thompson.

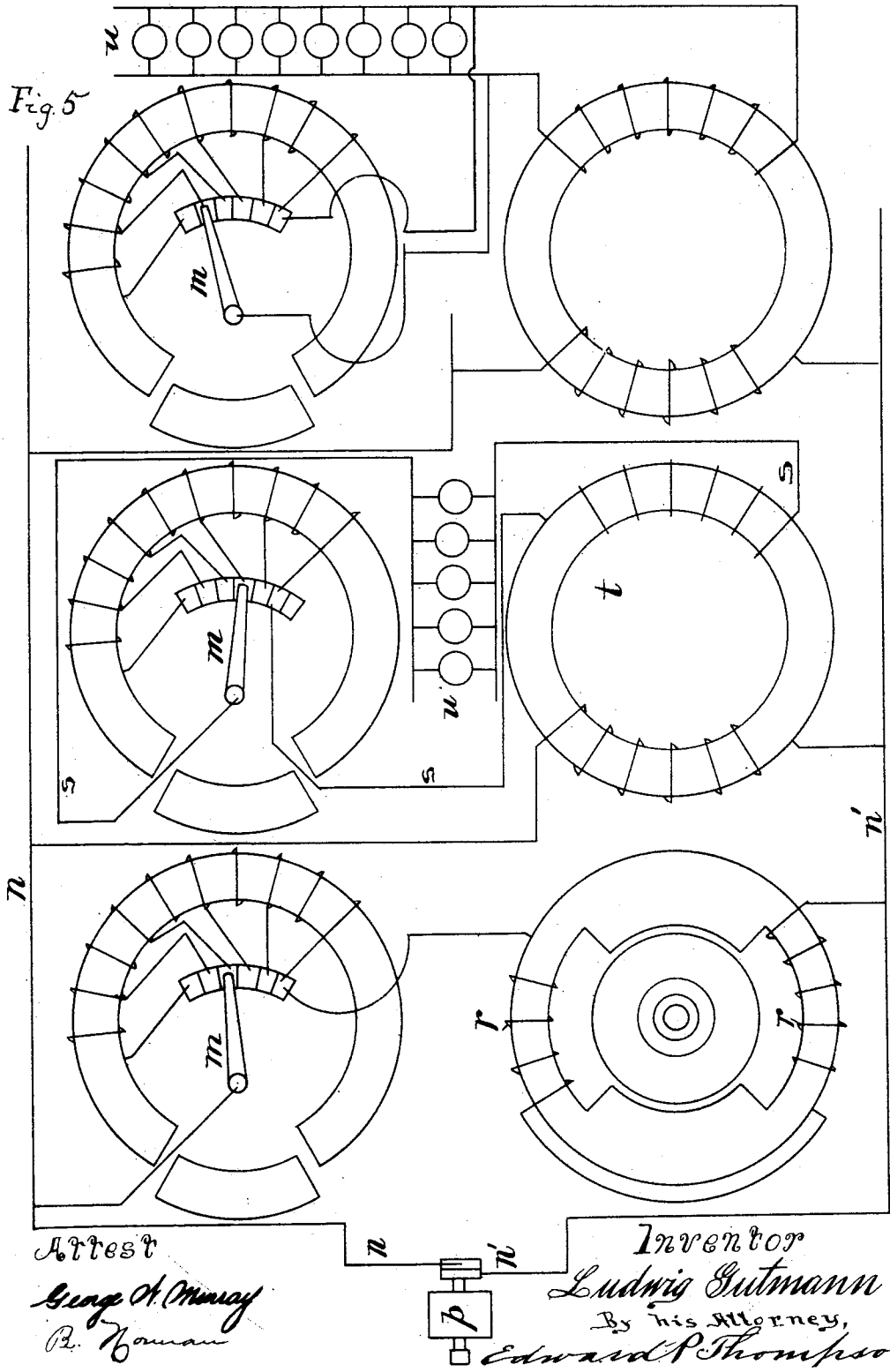
(No Model.) 3 Sheets—Sheet 3.

L. GUTMANN.

CHOKING ELECTRO MAGNET.

No. 424,606. Patented Apr. 1, 1890.

Fig. 5



Attest
George H. Murray
R. Newman

Inventor
Ludwig Gutmann
By his Attorney,
Edward P. Thompson.

UNITED STATES PATENT OFFICE.

LUDWIG GUTMANN, OF FORT WAYNE, INDIANA.

CHOKING ELECTRO-MAGNET.

SPECIFICATION forming part of Letters Patent No. 424,606, dated April 1, 1890.

Application filed December 12, 1888. Serial No. 293,332. (No model.)

To all whom it may concern:

Be it known that I, LUDWIG GUTMANN, a citizen of the German Empire, and a resident of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Choking Electro-Magnets, of which the following is a specification.

My invention relates to a choking-magnet to be employed especially with alternating, pulsating, or intermittent current circuits for the purpose of regulating and varying the current and its electro-motive force.

My invention consists of a device more particularly described by reference to the accompanying drawings, in which—

Figures 1, 2, and 4 are sectional views of the device. Fig. 3 is a modification in the coil-connections; and Fig. 5 represents the application of the device to a full working-circuit, in which the translating devices may be, for instance, incandescent electric lamps, motors, &c.

Referring to the figures, *a* is the coil-inclosing core. *a''* is the outer portion of the said core. *a'''* is the inner portion of the same core. *b''* is a movable core. *c* is the winding or subdivisions of the coils. *o* are the contact-blocks, to which the subdivisions of the winding or coils are connected. *q* is an open space in the core for the passage of the wire-terminals through the core to contact-blocks *d*. *f* and *g* are special starting-terminals. (Shown in Fig. 3.) *h* is a switch. *k* is an independent contact-block. 1, 2, 3, 4, 5, 6, 4′, 5′, and 6′ are the contact-blocks of the modified coil represented in Fig. 3. *l* is a screw or slide on the contact-arm of the choking-magnet. *m* is the contact-slide. *m′* is the contact arm or lever. *n n′* is the distributing-circuit. *p* is the alternating, pulsating, or intermittent current generator. *r* is a motor. *s* is the secondary circuit of a converter. *t* is the converter. *u* are translating devices.

Figs. 1 and 2 show the construction of the choking-magnet, which consists of a core *a*, inclosing a winding of a number of coils *c* in such a manner that the cross-section of the core is not the same all over. It will be noticed that the external part *a''* is wider than the part in the inside of the coil, which latter part is marked *a'''*. This is just the reverse to the general practice. A laminated core *b*, which can change its position relative to the coils and inclosing-core, is provided to produce changes in pressure and current in a circuit in which the coils are included. The reason is this: Owing to the smaller cross-section of the central portion of the core *a'''* this part will be much quicker saturated than the external part when the current increases and the choking-power of the coil would have reached its limit. To be able to vary and increase the choking capacity, a movable core *b* is added, which, when inserted, will of course increase the internal thickness of the core. This will cause a reduction in the concentration of lines of force in the core part *a'''*, reduce its resistance, and increase the choking capacity, because the central part *a'''* is farther away from saturation and is capable of taking up more lines of force. The more of the core *b* is introduced in the winding *c* and the more of the central part *a'''* is surrounding the core *b* the smaller will be the magnetic resistance of the core and the greater the choking capacity of the coils *c*.

To be able to adjust and regulate approximately before using the core, the winding is subdivided and connected to contact-blocks *d*, over which a contact slide or lever *m* is made to slide. The coils *c*, which may have either the same cross-section all through, or, as shown in Figs. 1 and 4, to have various cross-sections, decreasing accordingly as the current is decreased, are shown connected in series with one another, and each joint is connected to a contact-block *d*. One end of the coil or its block *d* is provided with a terminal to receive the line-wire. The other connection to line is made on contact-slide *m*, which is provided with a suitable terminal, or else this second line-connection is made to an independent bar which is constantly in electric connection with contact-slide *m*. (See Fig. 4.) To be able to adapt the winding when required to control currents of greater quantities than the wire is really capable of carrying without undue heating, the coils or winding is subdivided and connected to terminal blocks in a special manner, as shown in Fig. 3. This disposition of connections permits

the coils to be all in series or else divided in groups to be connected in parallel, thereby increasing the cross-section of the wire.

The coil shown consists of six subdivisions divided into two independent groups of each three in series connection. Block *f* is the starting terminal or contact for the line and also of one group of the coils, while contact-block *g* is the starting-block of the second group of coils. The ends of the subdivisions of the first group of coils are connected to the blocks marked 1, 2, and 3, and the ends of subdivisions or coils of the second group are connected to blocks 4, 5, and 6. These latter contact-blocks are connected to a second set of contact-blocks, (marked 4′, 5′, and 6′,) which blocks are fixed parallel to but insulated from blocks 1, 2, and 3. A switch *h* is mounted on contact-block *g*, and is adapted either to touch terminal block 3 or else the block *k*. This block *k* is permanently in electric connection with contact-block *f*.

The switch-lever *m′* is provided with a screw or groove *l*, on which the contact-slide *m* can be moved, so as to be closer to the fixed center round which the lever turns, or farther away from it. For ordinary currents the groups are arranged in series, and under these circumstances the switch *h* connects block *g* with block 3, while the sliding contact *m* is removed farthest from the center, resting against the enlarged end of the lever *m′*, which said enlarged end may be a screw-head larger than the hole in the contact-slide. When contact-slide *m* is resting on block *f*, the current would flow from the source *p* to block *f*, contact-slide *m*, contact-lever *m′*, translating devices *u*, and to the opposite terminal of the generator, none of the coils of the choking-magnet being in circuit.

When contact-slide *m* is shifted to the left and makes contact with block 1, one sub-coil is in circuit with the translating devices and the current flows from the generator *p* to block *f*, through coil I to contact-block 1, to contact-slide *m*, contact-arm *m′*, to translating devices *u*, and to the second terminal of the generator *p*.

If contact-slide *m* is placed on contact-block 2, the current would flow from generator *p* to block *f*, coil I to contact-block 1, coil II, contact-block 2, to contact-slide *m*, to lever *m′*, translating devices *u* to the second terminal of the generator *p*. In a similar manner the current will flow through the third coil if the contact-slide *m* rests either on block 3 or on block *g*, and when contact-slide *m* is connected to blocks 4, 5, and 6 the fourth, fifth, and sixth coil will be inclosed into the circuit, respectively.

If there is an extra amount of load in circuit more than each of the coils ought to carry, then lever *h* is thrown over to contact-block *k* and contact-slide *m* is moved more to the center, where the lever *m′* may be provided with a flange to prevent the contact-slide *m* moving any further than required. This latter position of contact-slide *m* is such as will enable it to touch simultaneously the two parallel sets of blocks 1 2 3 and 4′, 5′, and 6′. It will be noticed that the winding *c* is now divided into two parts, of which the two commencements of coils I and IV are connected to contact-block *f*, while the ends of each group connected to contact-blocks 3 and 6′, respectively, are open.

When contact-slide *m* is resting on contact-block *f*, the whole winding is out of circuit, as in the former case of series arrangement. When shifted to the left, so as to rest on blocks 1 and 4′, the current goes from generator *p* to block *f*, block *k*, lever *h*, and block *g*, simultaneously through coil I and IV to blocks 1 and 4′, contact-slide *m*, lever *m′*, translating devices *u* to the second terminal of the generator. When the contact-slide *m* rests on contact-blocks 2 and 5′ or on blocks 3 and 6′, the current will flow in a similar manner as described through coils I II and IV V, and also coils I, II, and III and IV, V, and VI in parallel at the same time, respectively, to the position of contact-slide *m*.

The core shown in Figs. 1 and 2 may consist of iron wire. The core inclosing the winding may be built up in any well-known manner by the adoption of iron wire or sheets parallel to each other, but independent and insulated from one another to prevent eddy-currents, in such a manner as to completely or almost cover the whole surface of the winding. An opening *e* is, however, left if the winding is completely inclosed, as shown in Fig. 2. This opening *e* is required to permit the ends of the inclosed winding to pass through the surrounding core to the contact-blocks *d*.

Fig. 4 is a modification of Figs. 1 and 2. In this choking-magnet the iron portion *a‴* of the core is entirely omitted. The introduction of the core *b* will cause more quickly any change and will be more abrupt than the disposition shown in Figs. 1 and 2. The winding shown in this figure consists, also, of different cross-section, as is more clearly shown, than in Fig. 1. This modification permits of a much larger range for choking capacity. The coils are so arranged in the circuit that the first coil to be introduced. has the largest cross-section, as it will have to carry the heaviest current. The pressure and current will be reduced on account of the resistance introduced by this first winding. It is evident that the second coil may be made of wire of smaller cross-section, the third of a still smaller section, and so on, the last to be introduced into the circuit having the smallest cross-section.

In Fig. 5 are shown main conductors *n n′*, connected to the alternating, pulsating, or intermittent current generator *p*. The choking-magnet represented in diagram in this figure is in principle the same as shown in Figs. 1 and 5.

At the left of Fig. 5 the choking-magnet is shown connected in series with the field-mag-

nets r of an electric motor. At the middle of the same figure the choking-magnet is connected in the secondary circuit s of a converter t, the primary circuit of the said converter being connected to the conductors n and n'. Translating devices u are connected in circuit with the converter.

At the right of Fig. 5 the choking-magnet is connected in multiple arc with the translating devices, while in the middle of the same figure the translating devices and the choking-magnet are connected in series.

I claim as my invention—

1. In a choking-magnet, the combination of multiple coils mounted upon a core hollow in the center, the said core enveloping the said coils at all points except where the terminals of the coils are connected, and a second core movable within the first core, the said coils being adapted to be connected in consecutive order in series with one another and with suitable translating devices.

2. In a choking-magnet, the combination of coils forming two or more independent groups whose ends are connected to a series of contact-plates over which is movable a contact-slide mounted upon an arm, main-line conductors connected to one of the contact-blocks and to the said contact-slide, a second set of contact-plates connected with the first-named plates of one or more independent groups of coils and within the path of the contact-slide, a screw or groove upon said contact-arm upon which the contact-slide is adjustable, to be in contact either with the contact-plates of the first set alone or in contact with the contact-plates of the first set as well as the second set, a two-way switch connecting normally the end contact-plate of one group with the starting contact-plate of the next group, and said switch being also adapted to connect the starting contact-plate of one group with the starting contact-plate of another group, and a suitable alternating-current generator in circuit with the said main-line conductors.

3. In a choking-magnet, the combination of a number of coils inclosed internally and externally by an iron core, the said iron core having a smaller cross-section in its internal part than in the external portion, and a movable core adapted to substantially fill the central hole which is provided in said coils.

4. In a choking-magnet, the combination of a number of coils inclosed internally and externally by an iron core, the core having a different cross-section in the part surrounded by the coils from that part surrounding the coils, a movable core adapted to increase the cross-section of the weaker portion, the inclosed coils being connected to contact-blocks, and a slide or contact-lever adapted to slide over the said contact-blocks, as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 6th day of December, 1888.

LUDWIG GUTMANN.

Witnesses:
WILLIAM C. RYAN,
DANIEL RYAN.