

March 27, 1928.

1,663,624

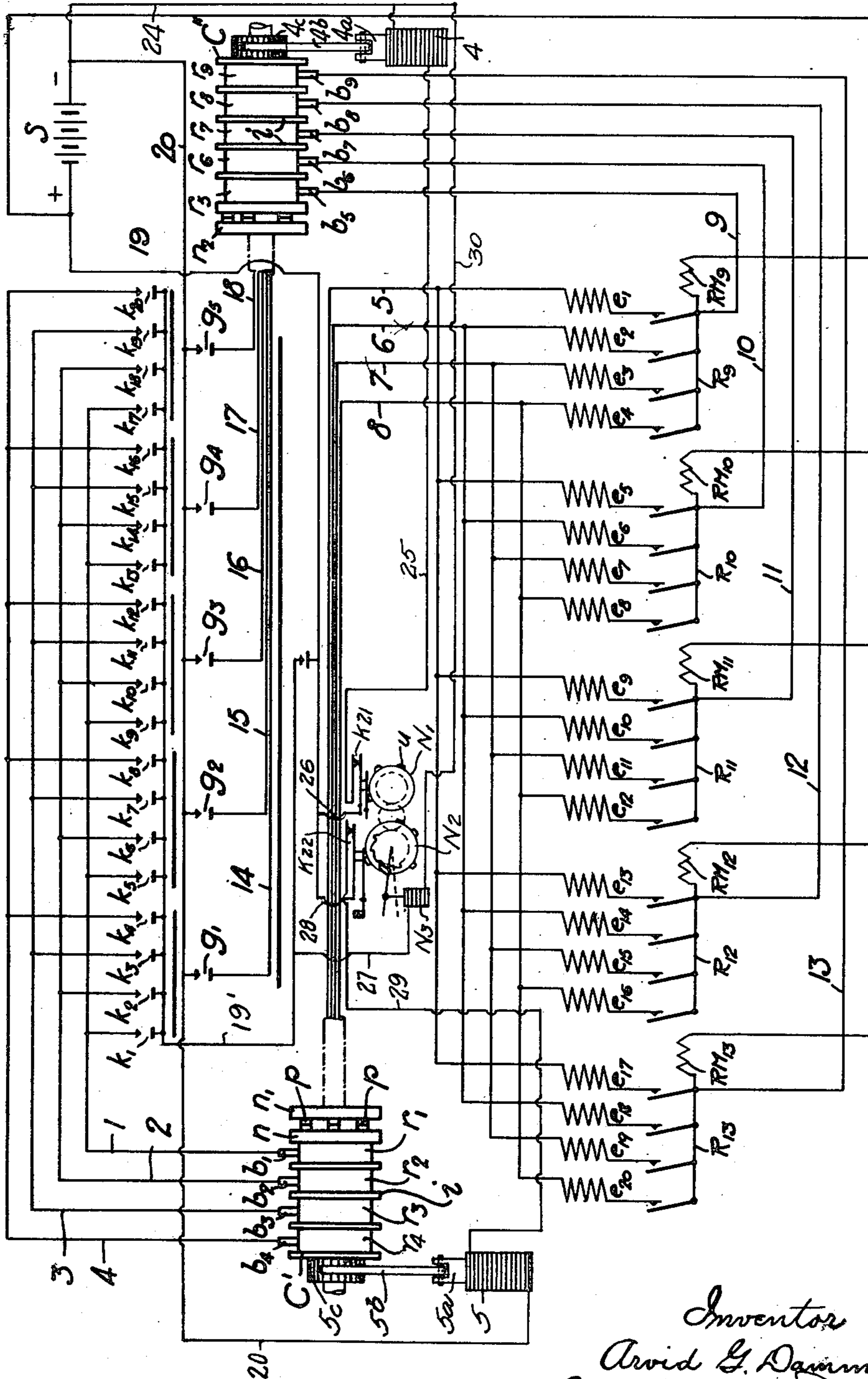
A. G. DAMM

ELECTRIC APPARATUS

Filed Aug. 31, 1925

2 Sheets-Sheet 1

FIG. 1.



Inventor  
A. G. Damm.  
By Henry Orth Jr. att.

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Fig. 2.

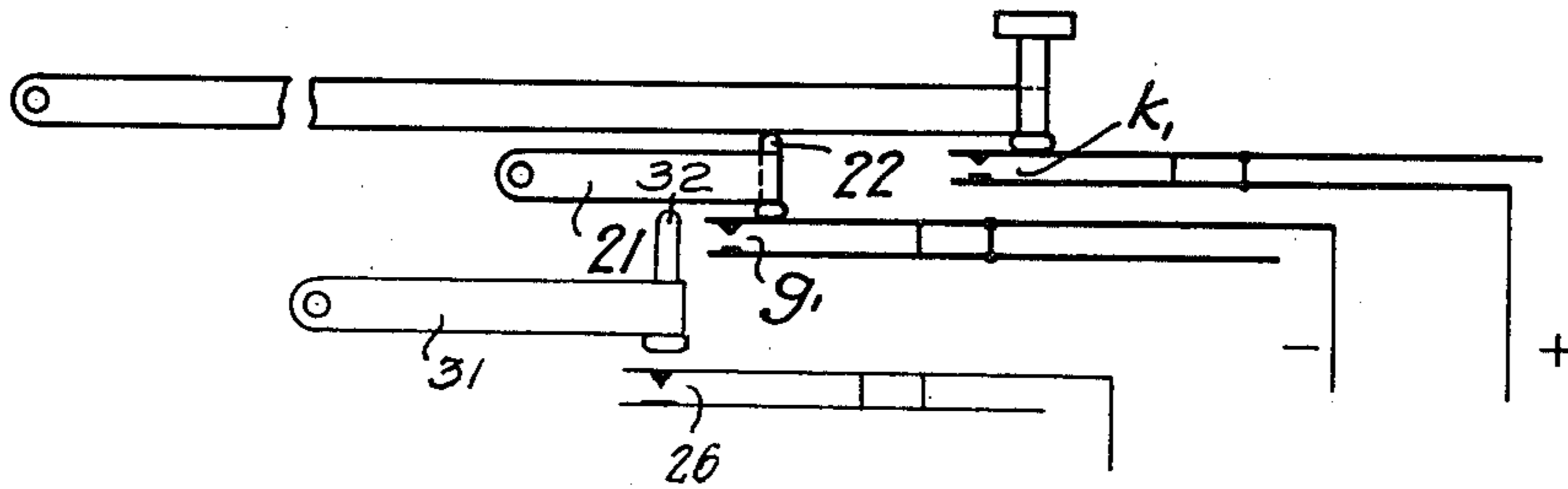


Fig. 3.

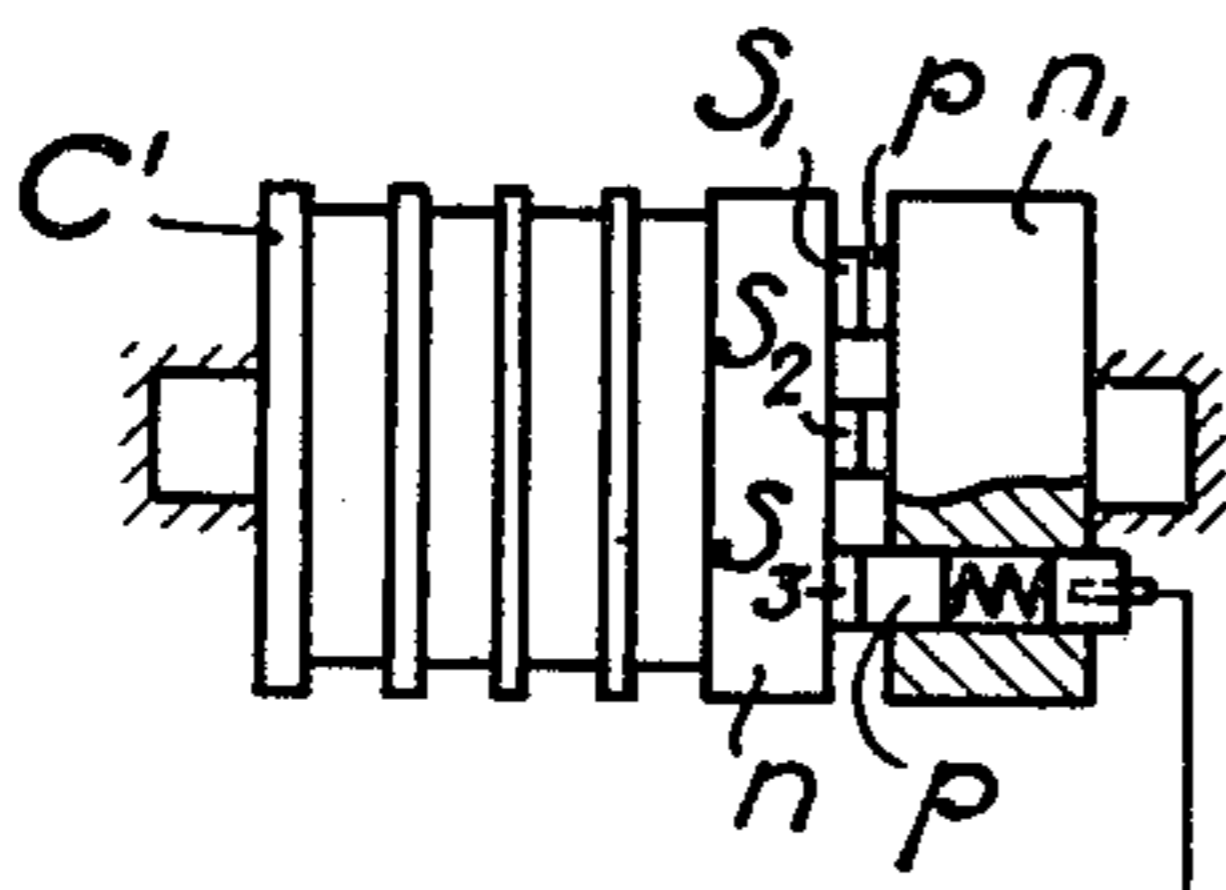


Fig. 4.

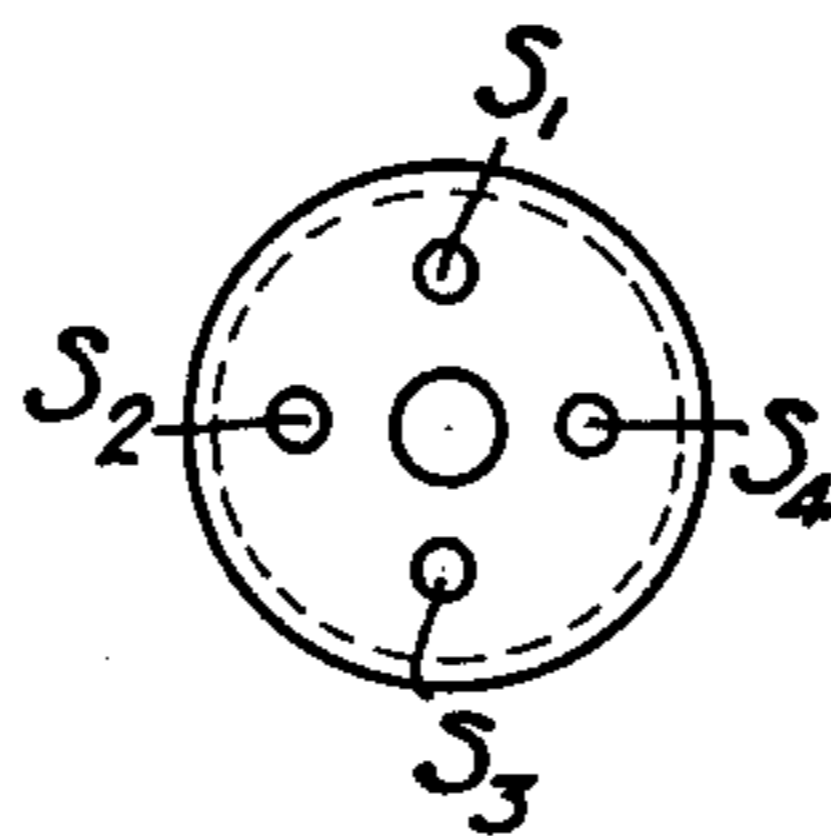
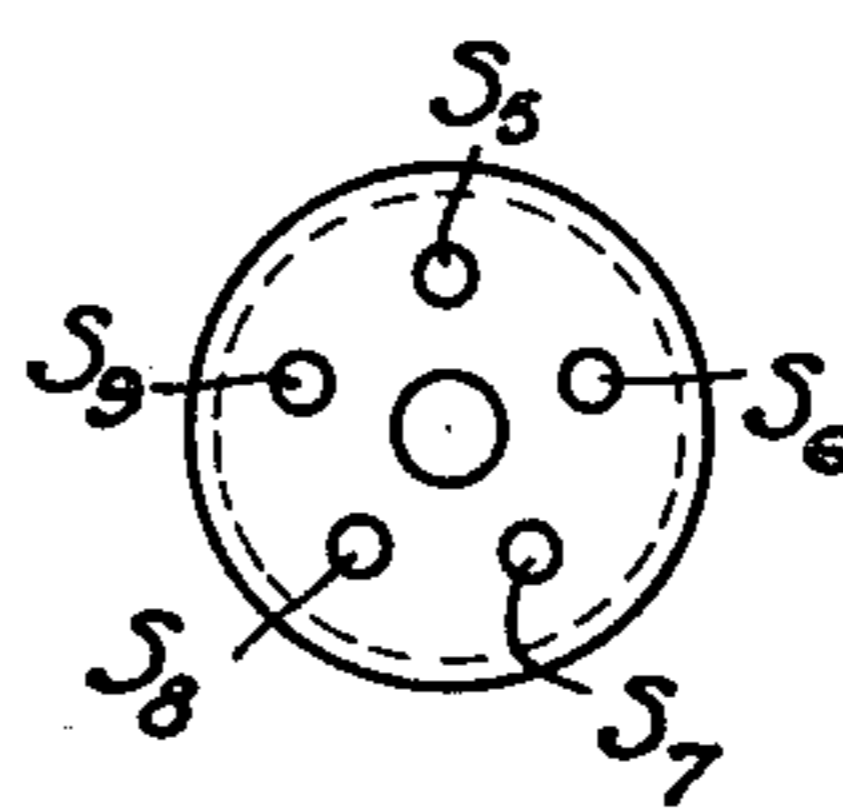


Fig. 5.



Inventor.  
A. G. Damm,  
By Henry Orth Jr atty.

## UNITED STATES PATENT OFFICE.

ARVID GERHARD DAMM, OF RONNINGE, SWEDEN.

## ELECTRIC APPARATUS.

Application filed August 31, 1925, Serial No. 53,628, and in Sweden June 27, 1924.

In my U. S. Patent Nos. 1,502,376 and 1,540,107 I have shown and described an apparatus for producing cipher documents in which I make use of two cylinders (ciphering cylinders) which during the ciphering operation are adjusted intermittently in relation to each other. Each of said cylinders has the same number of contact pins, contact rings and connections therebetween as the number of signs of the series of signs used or the number of keys of the sender key board. On account thereof said cylinders are rather expensive and difficult to manufacture.

The object of the present invention is to simplify the construction of said ciphering cylinders so that they may be made of a smaller size and at lower costs than the old cylinders. At the same time the advantage will be attained that their movements owing to the reduced mass and the reduction of the number of points of friction may be accomplished at a higher speed and with a lower consumption of electric energy than heretofore.

The essential feature of the invention resides in this that the said members or ciphering cylinders have together such a number of contact rings and corresponding contact pins that the number of contact rings of the one cylinder multiplied by the number of contact rings of the other cylinder will give a product which corresponds to the number of signs of the series of signs used, the contacts operated by the keys of the sender key board being arranged in groups the number of which corresponds to the number of contact rings of the one ciphering cylinder and which are electrically connected to the other ciphering cylinder in such a manner that each contact ring of the latter is in connection with one contact of each of said groups of contacts while the contact pins of the said other cylinder are in engagement with contact pins provided in a fixed contact supporter and connected in such a manner to the electromagnetic members of the cipher typewriter or perforator, which members are likewise arranged in groups, that each contact pin is connected to one electromagnetic member of each group of such members, all electromagnetic members of each group being connectible by means of a group relay to a contact ring of the first mentioned ciphering cylinder, said contact ring being connected by a conductor to the winding of

said group relay which winding in its turn is direct connected to the source of electric current, the contact pins of said first mentioned ciphering cylinder engaging each a contact pin of a fixed contact supporter, each of the contact pins of this contact supporter being connected to one of a number of contacts each one of which is arranged to be operated by any one of the keys of a group of keys of the sender key board.

In the accompanying drawing I have shown diagrammatically one embodiment of my invention to be used in connection with a series of signs composed of 20 different signs. In such case the one ciphering cylinder has for instance four contact rings and the other five. Fig. 1 is a diagram, Fig. 2 is a diagrammatic side view of a key of the sender key board and the contacts operated by the same, and Fig. 3 is a side view of the one cylinder and the corresponding fixed contact supporter shown partially in section. Figs. 4 and 5 show end views of the ciphering cylinders.

For each key of the sender key board, i. e. the key board operated in accordance with the text given (in ciphering) or the cipher (in deciphering) a contact  $k_1-k_{20}$  (Fig. 1) is provided, which is closed when the corresponding key is depressed. All said contacts can be connected for instance to the positive pole of a source of current S through a conductor 19 and a conductor 19' by closing a contact  $g$ , hereinafter described. Further said contacts are connected in groups to brushes  $b_1-b_4$  bearing against the ciphering cylinder  $C^1$ . In the example shown the first contact to the left of each group of five contacts,  $k_1, k_5, k_9, k_{13}$  and  $k_{17}$ , is connected to the brush  $b_1$  through a conductor 1. The second contact of each group,  $k_2, k_6, k_{10}, k_{14}$  and  $k_{18}$  is connected to the brush  $b_2$  through a conductor 2. The third contact of each group,  $k_3, k_7, k_{11}, k_{15}$  and  $k_{19}$ , is connected to the brush  $b_3$  through a conductor 3, while the fourth contact of each group,  $k_4, k_8, k_{12}, k_{16}$  and  $k_{20}$ , is connected to the brush  $b_4$  through a conductor 4. The ciphering cylinder  $C^1$  consist as in the prior patents referred to above of metal rings  $r_1, r_2, r_3, r_4$  separated from each other by insulating material  $i$ . The brushes  $b_1-b_4$  bear each against one of said metal rings  $r_1-r_4$ , while the latter are each connected to a contact pin  $s_1-s_4$  disposed in the insulating end piece  $n$  of the ciphering cylinder  $C^1$ .

Bearing against said contact pins  $s_1-s_4$  are contact pins  $p$  disposed in a fixed contact supporter  $n_1$  of insulating material. The ciphering cylinder  $C^1$  is rotatably journaled and adapted to be rotated stepwise, each step corresponding to one fourth of a revolution. It may be rotated by means of a solenoid 4 to the core  $4^a$  of which is pivotally connected a pawl  $4^b$ , engaging a ratchet wheel  $4^c$  rigidly secured to the cylinder  $C^1$ . The said solenoid may be excited by similar means to those described in my U. S. Patent No. 1,502,376 with respect to the solenoids  $S_4$  and  $S_5$ . One end of the winding of the solenoid 4 is connected through a conductor 24 to the negative pole of the source of current S, while the other end of said winding is connected through a wire 25 to a contact  $k_{21}$  which by a wire 26 is connected to the conductor 19<sup>1</sup>. The contact  $k_{21}$  is operated by a rotary disc  $N_1$  having at its circumference a number of projections  $u$  adapted to close the contact  $k_{21}$  when passing the same as described in my U. S. Patent No. 1,502,376.

The electromagnetic members which in accordance with the Patent No. 1,502,376 serve to depress the keys of the cipher typewriter or perforator and are indicated by  $e_1-e_{20}$  in Fig. 1 are on the one hand connected in groups to the contact pins of the fixed contact supporter  $n_1$  and can on the other hand be connected in groups to brushes  $b_5-b_9$  bearing against the ciphering cylinder  $C''$ . The connection between the contact pins  $p$  of the fixed contact supporter  $n_1$  and the electromagnetic members  $e_1-e_{20}$  is analogous with the connection between the brushes  $b_1-b_4$  and the contacts  $k_1-k_{20}$ , the said electromagnetic members being connected in groups with the contact pins  $p$  through conductors 5, 6, 7, 8. The electromagnetic members  $e_1-e_{20}$  are arranged in five groups each comprising four members. The first member to the right of each group,  $e_1, e_5, e_9, e_{13}$  and  $e_{17}$  is connected to one of the contact pins  $p$  through the conductor 5. The second electromagnetic member of each group,  $e_2, e_6, e_{10}, e_{14}$  and  $e_{18}$  is connected to another of said contact pins  $p$  through the conductor 6, while the conductors 7 and 8 connect the third and the fourth electromagnetic member of each group with the two other contact pins  $p$ . All electromagnetic members of each group  $e_1-e_4, e_5-e_8, e_9-e_{12}, e_{13}-e_{16}$  and  $e_{17}-e_{20}$  can be connected by means of a group relay  $R_9, R_{10}, R_{11}, R_{12}$  and  $R_{13}$  respectively with a conductor 9, 10, 11, 12 and 13 respectively and thereby each with one of the brushes  $b_5, b_6, b_7, b_8, b_9$  bearing against the ciphering cylinder  $C''$ . The windings of said relays are indicated by  $RM_9, RM_{10}, RM_{11}, RM_{12}$ , and  $RM_{13}$ . Said windings are each connected to the positive pole of the source of current S and to one of

the conductors 9, 10, 11, 12 and 13. The ciphering cylinder  $C''$  is composed of five contact rings  $r_5, r_6, r_7, r_8$  and  $r_9$  insulated from one another and each connected to one of contact pins  $s_5-s_9$  disposed in the insulating end piece of the ciphering cylinder  $C''$  at equal distance from one another. The ciphering cylinder  $C''$  may be rotated by means of a solenoid 5 to the core  $5^a$  of which is pivotally connected a pawl  $5^b$  engaging a ratchet wheel  $5^c$  rigidly secured to the cylinder  $C''$ . The said solenoid may be excited by similar means as those described in my U. S. Patent No. 1,502,376 with respect to solenoids  $S_4$  and  $S_5$ . One end of the winding of the solenoid 5 is connected through a conductor 20 to the negative pole of the source of current S, while the other end of said winding is connected through a wire 29 to a contact  $k_{22}$  which by a wire 28 is connected to the conductor 19<sup>1</sup>. The contact  $k_{22}$  is operated by a disc  $N_2$  having at its circumference a number of projections  $u$  adapted to close the contact  $k_{22}$  in passing the same. The disc  $N_2$  is rotated by means of a solenoid  $N_3$ , a pawl and a ratchet wheel in the same manner as the disc  $N_1$  in my U. S. Patent No. 1,502,376 is rotated by means of the solenoid  $S_3$  and serve to rotate the disc  $N_2$  by means of a suitable gearing. The winding of the said solenoid  $N_3$  is connected through a wire 27 to the conductor 19<sup>1</sup> and through a wire 30 to the conductor 24. Against each of said contact pins  $s_5-s_9$  a contact pin  $P_2$  is bearing. Said contact pins  $p_2$  are provided in a fixed contact supporter  $n_2$  of insulating material and each of them is connected through a conductor 14, 15, 16, 17, 18 to a contact  $g_1, g_2, g_3, g_4$  and  $g_5$  respectively, connected to the negative pole of the source of current S through a conductor 20. Each of the contacts  $g_1-g_5$  is so arranged that it will be closed when any one of the keys of the corresponding group of keys is depressed. For this purpose each of the contacts  $g_1-g_5$  may be actuated by means of a pivoted arm 21, Fig. 2, supporting a rod 22 which extends along a group of keys. The contact  $g_6$  is actuated by a pivoted arm 31, Fig. 2, supporting a rod 32 which extends along the group of rods 21, so that the contact  $g_6$  will be closed every time any one of the keys of the sender board is depressed. When any one of the keys is depressed, only one of the electromagnetic members  $e_1-e_{20}$  will be excited. This will be evident from the following. If, for instance, the key corresponding to the contact  $k_3$  be depressed said contact and also the contact  $g_1$  will be closed. The current now passes from the positive pole of the source of current S through conductor 19, contact  $g_6$ , conductor 19<sup>1</sup> contact  $k_3$ , conductor 3, brush  $b_3$ , contact ring  $r_3$ , contact pin  $s_3$ , and thereupon, depending on the position of the ciphering

cylinder  $C^1$  in relation to the fixed contact supporter  $n_1$ , through one of the conductors 5—8, for instance 8, and further through the last electromagnetic member of that group of such members the winding of which is in connection with the contact  $g_1$  through the ciphering cylinder  $C''$  and back to the negative pole of the source of current. At the same time current flows from the positive pole of the source of current  $S$  through conductor 19, contact  $g_6$ , conductor 19<sup>1</sup>, wire 27, solenoid  $N_3$ , wire 30 and conductor 24 to the negative pole of the source of current. The solenoid  $N_3$  thus attracts its core. When the key depressed is released, the contact  $g_1$ , and  $g_6$  are broken, and the core of the solenoid  $N_3$  thus turns the discs  $N_1$  and  $N_2$ , thereby closing momentarily one or both of the contact  $k_{21}$  and  $k_{22}$ . If the contact  $k_{21}$  be closed, current flows from the positive pole of the source of current  $S$  through conductor 19, wire 26, contact  $k_{21}$ , wire 25, solenoid 4 and conductor 24 to the negative pole of the source of current. The solenoid 4 thus turns the cylinder  $C''$  one step. If the contact  $k_{22}$  be closed, current flows from the positive pole of the source of current through conductor 19, wire 28, contact  $k_{22}$ , wire 29, solenoid 5, and conductor 20 to the negative pole of the source of current. The solenoid 5 thus turns the cylinder  $C'$  one step.

Though the ciphering cylinders described above have a very small number of contact rings compared with the ciphering cylinders described in my patents referred to above it is possible by means of the same to substitute for any arbitrary sign of the series of signs used any other sign of said series.

What I claim is:

1. In an electric ciphering apparatus of the kind set forth the combination of a source of electric current, a sender key board, a cipher typewriter or perforator, electric contacts operated by the keys of said sender key board, electrical connections between said contacts and the said source of electric current, two ciphering cylinders, electrical connections between said contacts and the one of said ciphering cylinders, electromagnetic members adapted to actuate the keys of said cipher typewriter or perforator, the ciphering cylinders having together such a number of contact rings that the number of contact rings of the one cylinder multiplied by the number of contact rings of the other cylinder will give a product which corresponds to the number of signs of the series of signs used, the contacts operated by the

keys of said sender key board being arranged in groups the number of which corresponds to the number of contact rings of the one of said ciphering cylinders, said groups of contacts being connected in such a manner to the contact rings of the other ciphering cylinder that one contact of each group of contacts is in connection with one of the contact rings of said other ciphering cylinder, contact pins provided in the latter, a fixed contact supporter, contact pins in the latter each engaging one of the contact pins of said other ciphering cylinder, electrical connections between the contact pins of said contact supporter and the said electromagnetic members the latter being connected groupwise to the contact pins of said contact supporter in such a manner that each contact pin is connected to one electromagnetic member of each group of such members, group relays each adapted to connect one group of electromagnetic members with one of the contact rings of the firstmentioned ciphering cylinder, said contact ring being connected to the winding of said group relay, said winding being connected to the said source of electric current, and electric contacts each adapted to be actuated by any one of a group of keys of the said sender key board and each being connected to a contact ring of the firstmentioned ciphering cylinder.

2. In an electric ciphering apparatus, a source of current, a sender key board divided into groups of keys, a recording device whose recording elements are divided into similar groups, a ciphering cylinder between the key-board and recording device, contacts in said cylinder each connected to a key of each group of keys, stationary contacts cooperating with the cylinder contacts and each connected to a recording element of each group of recording elements, a second cylinder having contacts each arranged for connection to an entire group of recording elements, a group connector for each group of recording elements electrically connected to one pole of the source of current and to a contact on said second cylinder, stationary contacts cooperating with the contacts on said second cylinder, a group of contacts each corresponding to a group of keys and operated by any key of the corresponding group, each of said latter contacts connected to the other pole of the current source and to the stationary contacts for said second cylinder.

In testimony whereof I have hereunto subscribed my name.

ARVID GERHARD DAMM.