May 7, 1929. W. W. STURDY 1,711,550

ALTERNATING CURRENT RELAY

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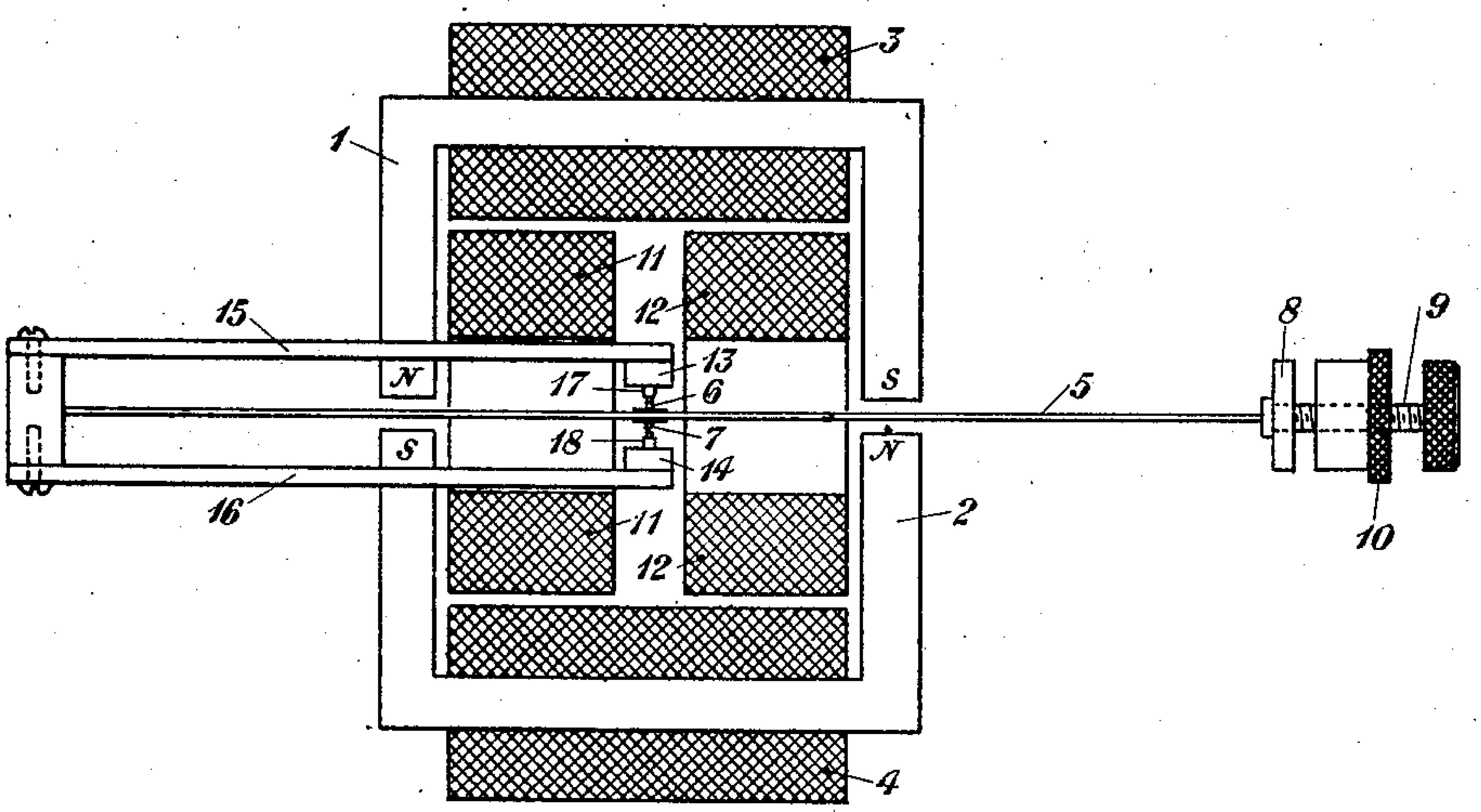

Fig. 1

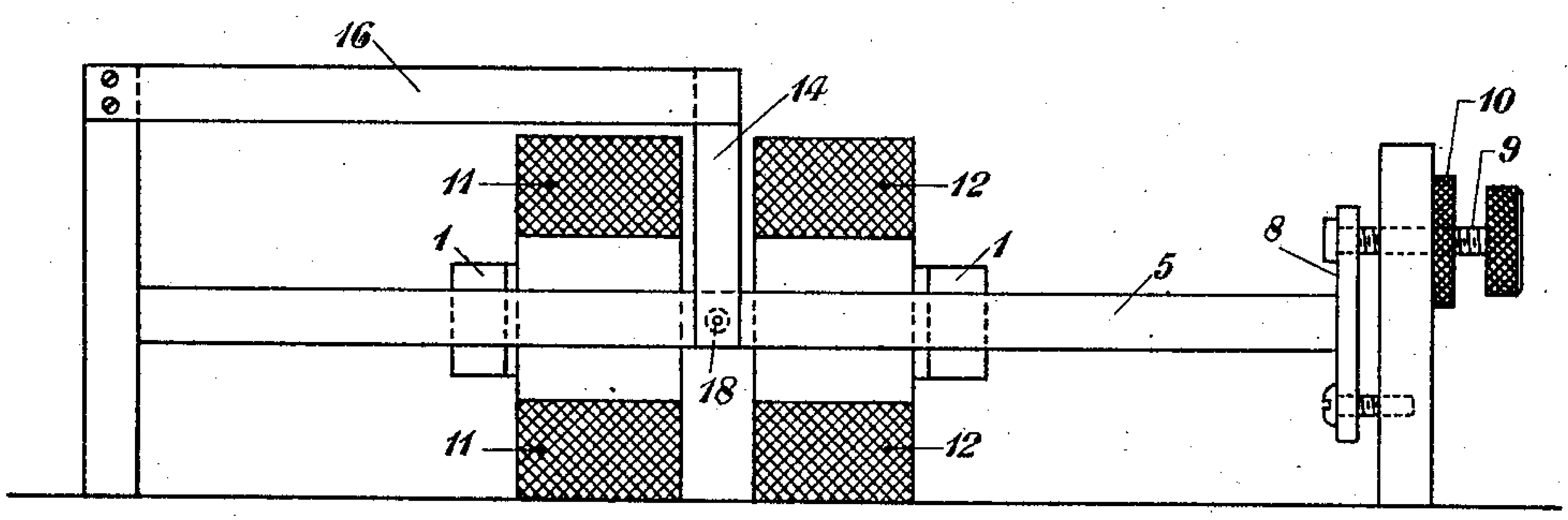

Fig. 2

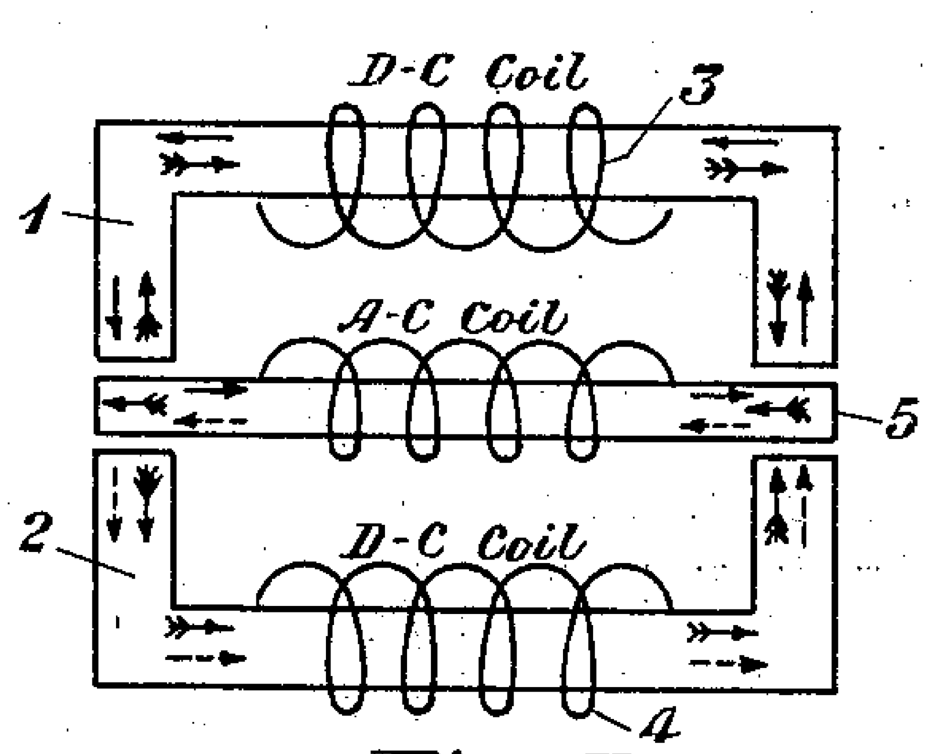

Fig. 3

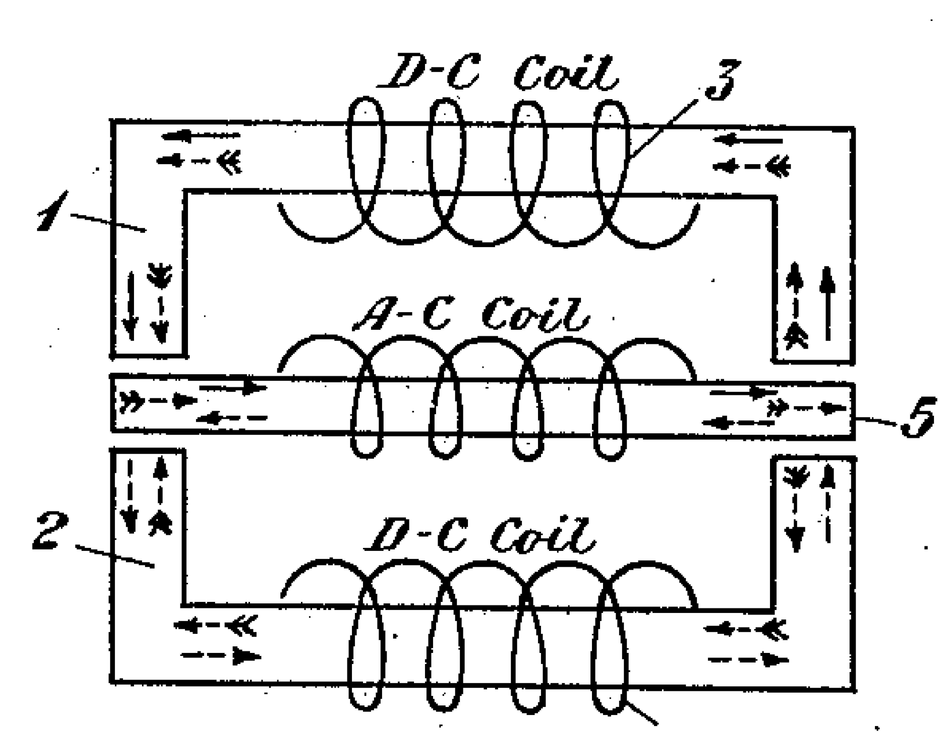

Fig. 4

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ALTERNATING CURRENT RELAY

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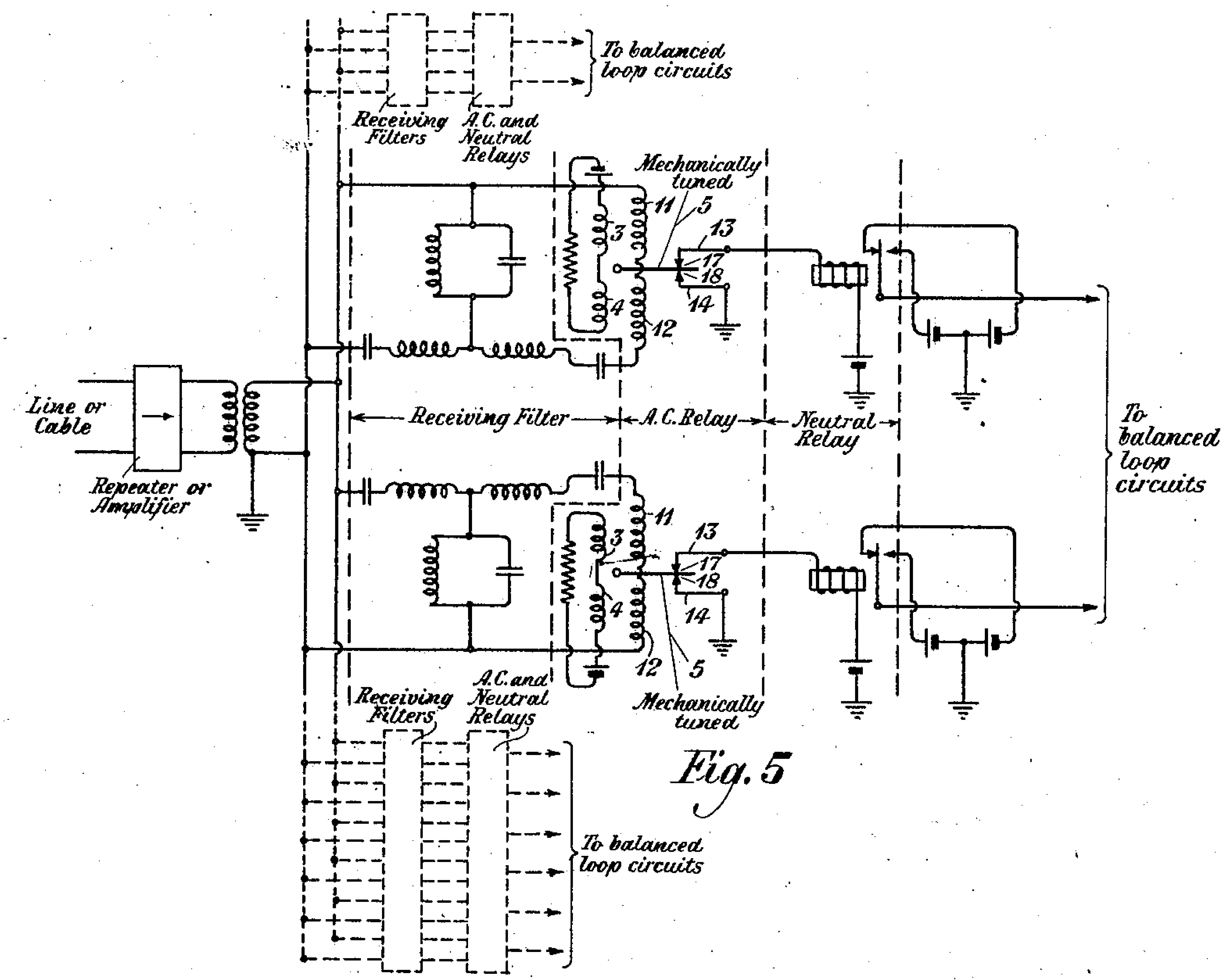

Fig. 5

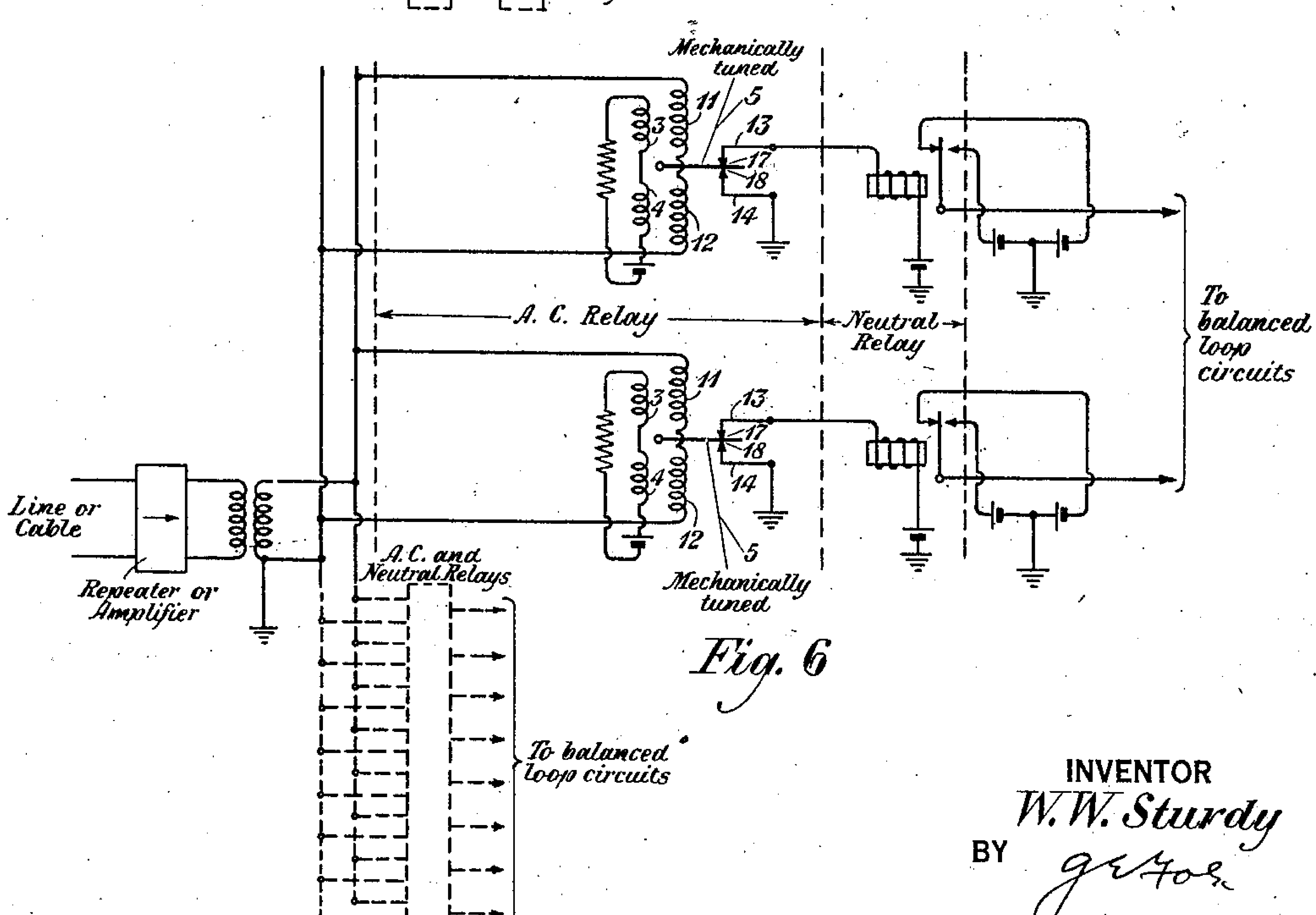

Fig. 6

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Patented May 7, 1929. 1,711,550

UNITED STATES PATENT OFFICE.

WILLIAM W. STURDY, BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

ALTERNATING-CURRENT RELAY.

Application filed August 6, 1925. Serial No. 48,638.

This invention relates to relays, and more particularly to alternating current relays for use in carrier telegraph circuits.

One object of the invention is to provide an alternating current relay which can be used in carrier telegraph circuits without receiving filters or with fewer receiving filter sections than are required with the relays heretofore employed. Other objects and advantages of the improved relay will be made clear in the following description.

The relay is a polar relay having a ribbon armature, of magnetic material, which vibrates between two electromagnets and is mechanically tuned to the desired natural frequency of vibration.

The following detailed description of the relay and the associated circuits is to be read with reference to the accompanying drawing. Figure 1 of the drawing is a top view of the device, partly in section, and Fig. 2 represents a side view, likewise partly in section. Fig. 3 is a diagram showing the magnetic flux in the cores of the electromagnets and the armature during the first half-cycle of the alternating current. Fig. 4 shows the same during the second half-cycle. Fig. 5 is a circuit diagram showing the carrier telegraph receiving circuits including two of applicant's relays and a reduced number of receiving filter sections, and Fig. 6 shows similar circuits without receiving filters. Like characters of reference in the several figures of the drawing designate corresponding parts.

With reference to the details of the drawing, and first with particular reference to Figs. 1 and 2, the U-shaped cores 1 and 2 are energized by the direct current coils 3 and 4, respectively, these coils being wound so as to give to the cores the polarity indicated in Fig. 1. The ribbon armature 5 is of a magnetic material of low hysteresis, such as permalloy, and carries the contacts 6 and 7, one on either side. The tension of the armature may be adjusted by suitable mechanical means, such as the device shown in the drawing and consisting of the member 8, which is attached to one end of the ribbon, and the adjusting screw 9, which controls the position of said member. The lock-nut 10 is provided to keep the tension substantially constant after adjustment has been made. The coils 11 and 12, surrounding the mid-section of the armature, carry the alternating current from the line.

The strip springs 13 and 14, of non-magnetic material, are carried on the supports 15 and 16, also of non-magnetic material, and are connected in series with the local direct current neutral relay circuit (see Figs. 4 and 5). When no alternating current is flowing over the line, these springs 13 and 14 make contact with the armature contacts 6 and 7, respectively, through the spring contacts 17 and 18 (see Fig. 1).

With particular reference to Figs. 3 and 4, the direct current coils are wound about the cores 1 and 2 so that the magnetic flux set up by the one coil, represented by the solid unfeathered arrows, and the flux set up by the other coil, represented by the broken unfeathered arrows, offset each other in the armature 5. As indicated above, the result is that, with no alternating current in the line, contact is made and remains made between the armature contacts 6 and 7 and the spring contacts 17 and 18, closing the circuit of the neutral relay. The body of the armature is not in the electrical circuit. When alternating current flows in the line and in the alternating current coils, the first half of the cycle adds algebraically to the magnetic fluxes caused by the direct current the flux represented by the solid feathered arrows, as shown in Fig. 3. The strengthening of the flux in the air-gaps on one side of the armature and the weakening of the flux in the air-gaps on the other side cause the armature 5 to move to one side, and break the contact between the armature and the spring contact on the other side, thus opening the neutral relay circuit. During the second half of the cycle the fluxes set up are as shown in Fig. 4, the flux represented by the broken feathered arrows being that due to the alternating current. The result is that the armature is moved in the other direction.

The springs 14 and 15, as indicated above, are of non-magnetic material, and should be of such dimensions and elasticity that their natural period of vibration lies between the period corresponding to the signal frequency and the period of the carrier wave, being nearer to the latter than to the former. Thus, in the second half cycle of the received alternating current, the armature breaks contact with one spring before making contact with the other, and consequently the local circuit of the neutral relay is kept open during the entire period of the incoming marking signal. At the termination of the marking signal, the armature ceases to vibrate, and the spring contacts return to their original positions, closing the neutral relay circuit.

By the means described above—or other suitable means—for adjusting the tension of the ribbon, the armature 5 can be tuned to the desired frequency, and the lock-nut serves to keep the tension substantially constant during operation of the relay. The relay should, of course, be made quite selective, as the number of receiving filter sections heretofore used in carrier telegraph circuits can thereby be materially reduced (see Fig. 5). If the relay is made sufficiently selective, it is readily understood that all receiving filters can be eliminated (see Fig. 6).

It is to be understood that, while applicant has specifically described his invention in one embodiment, which is deemed desirable, various changes from that embodiment may be made without departing from the spirit of the invention, which is defined in the appended claims.

What is claimed is:

1. An alternating current relay comprising an alternating current coil, an armature, two springs normally in contact with said armature, electromagnetic means for causing said armature to vibrate in response to current flow in said coil and to break contact with said springs alternately, and means for adjusting the natural frequency of vibration of said armature.

2. An alternating current relay comprising an armature, electromagnetic means for causing said armature to vibrate in response to alternating current flow, means for adjusting the natural frequency of vibration of the armature, and two springs so constructed and positioned that normally both springs make contact with the armature but during the flow of alternating current only one spring at a time makes contact with the armature.

3. An alternating current relay comprising two electromagnets, an alternating current coil, an armature designed to vibrate between said electromagnets in response to current flow in said coil, two springs normally in contact with said armature, the vibration of said armature causing the same to break contact with said springs alternately, and means for adjusting the natural frequency of vibration of said armature.

4. In a carrier telegraph system including a line and a local direct current neutral relay circuit, means for breaking said circuit in response to alternating current coming in over said line, said means consisting of an alternating current relay comprising an armature, electromagnetic means for causing said armature to vibrate in response to current coming in over said line, and means associated with said armature for causing the vibration thereof to open the neutral relay circuit.

5. In a carrier telegraph system including a line and a local direct current neutral relay, an alternating current relay comprising an armature, electromagnetic means for causing said armature to vibrate in response to alternating current coming in over said line, means associated with said armature for breaking the circuit of the direct current relay during the vibration of the armature, and means for adjusting the natural frequency of vibration of the armature.

6. In a carrier telegraph system including a line and a local direct current neutral relay, an alternating current relay comprising two electromagnets, an alternating current coil in series with the line, an armature designed to vibrate between said electromagnets in response to current flow in the line, two springs in series with the neutral relay and normally in contact with said armature, the vibration of said armature causing the same to break contact with said springs alternately, and means for adjusting the natural frequency of vibration of said armature.

7. In a carrier telegraph system including a line and a local direct current neutral relay, an alternating current relay comprising an alternating current coil in series with the line, a source of direct current, two electromagnets having their coils in series with said source, an armature designed to vibrate between said electromagnets in response to alternating current flow in the line, means associated with said armature for breaking the neutral relay circuit during the vibration of the armature, and means for adjusting the natural frequency of vibration of the armature.

8. In a carrier telegraph system including a line and a local direct current neutral relay circuit, an alternating current relay for breaking the neutral relay circuit in response to alternating current flow in the line, said alternating current relay comprising an armature, electromagnetic means for causing said armature to vibrate in response to current flow in the line, two springs in series with said neutral relay and normally in contact with said armature, the vibration of said armature causing the same to break contact with said springs alternately, and means for adjusting the natural frequency of vibration of said armature.

In testimony whereof, I have signed my name to this specification this 4th day of August, 1925.

WILLIAM W. STURDY.