

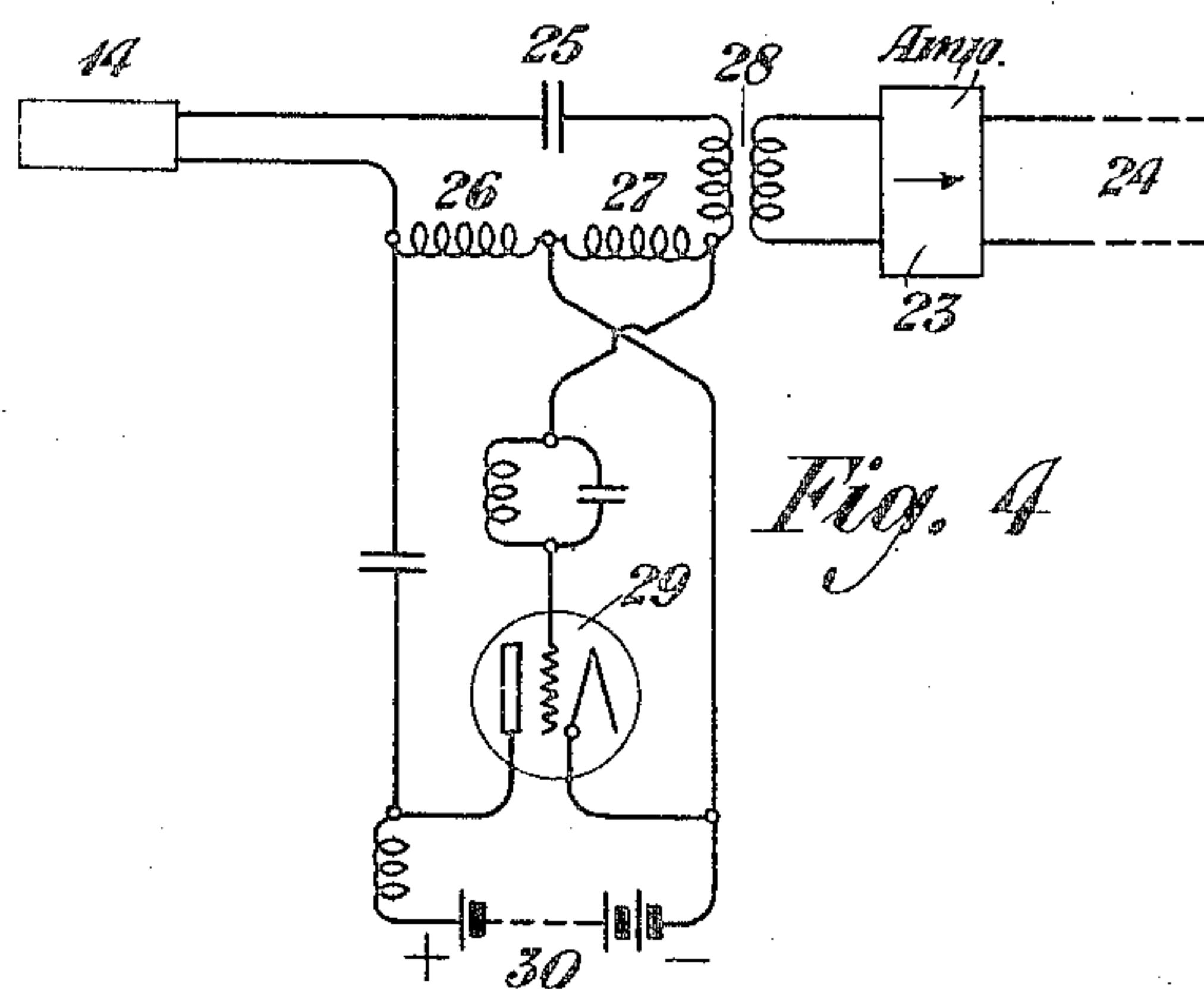
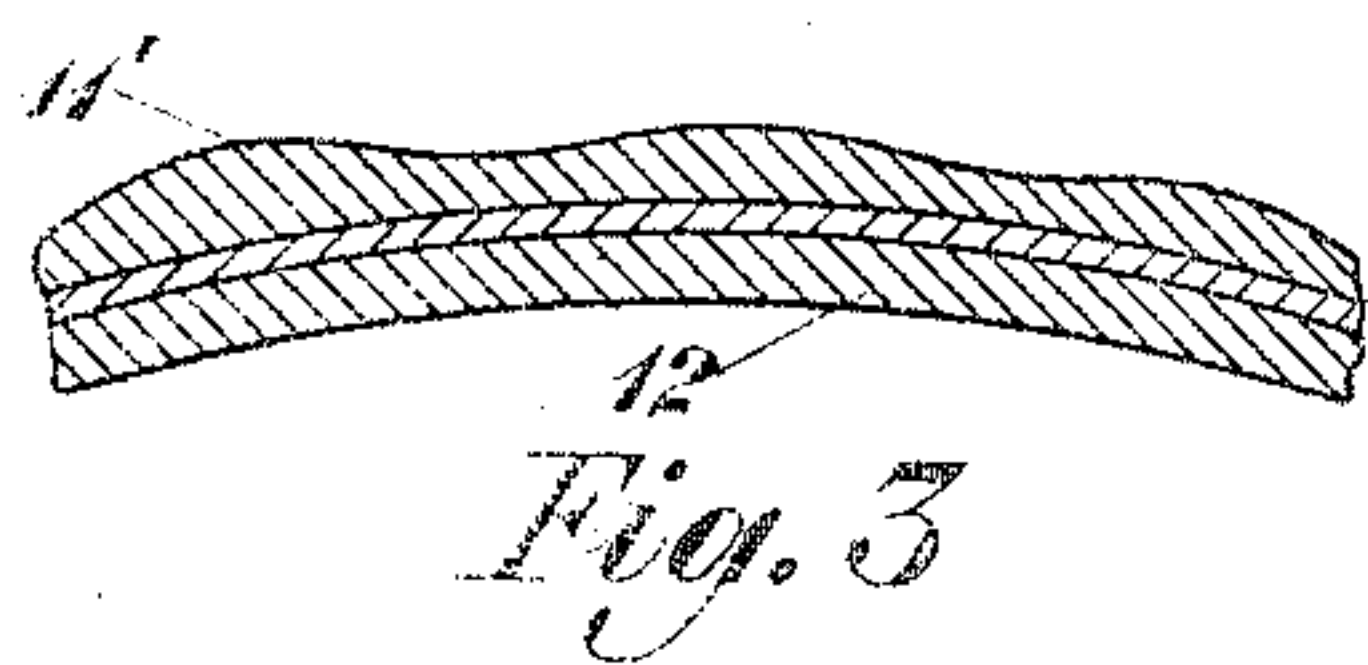
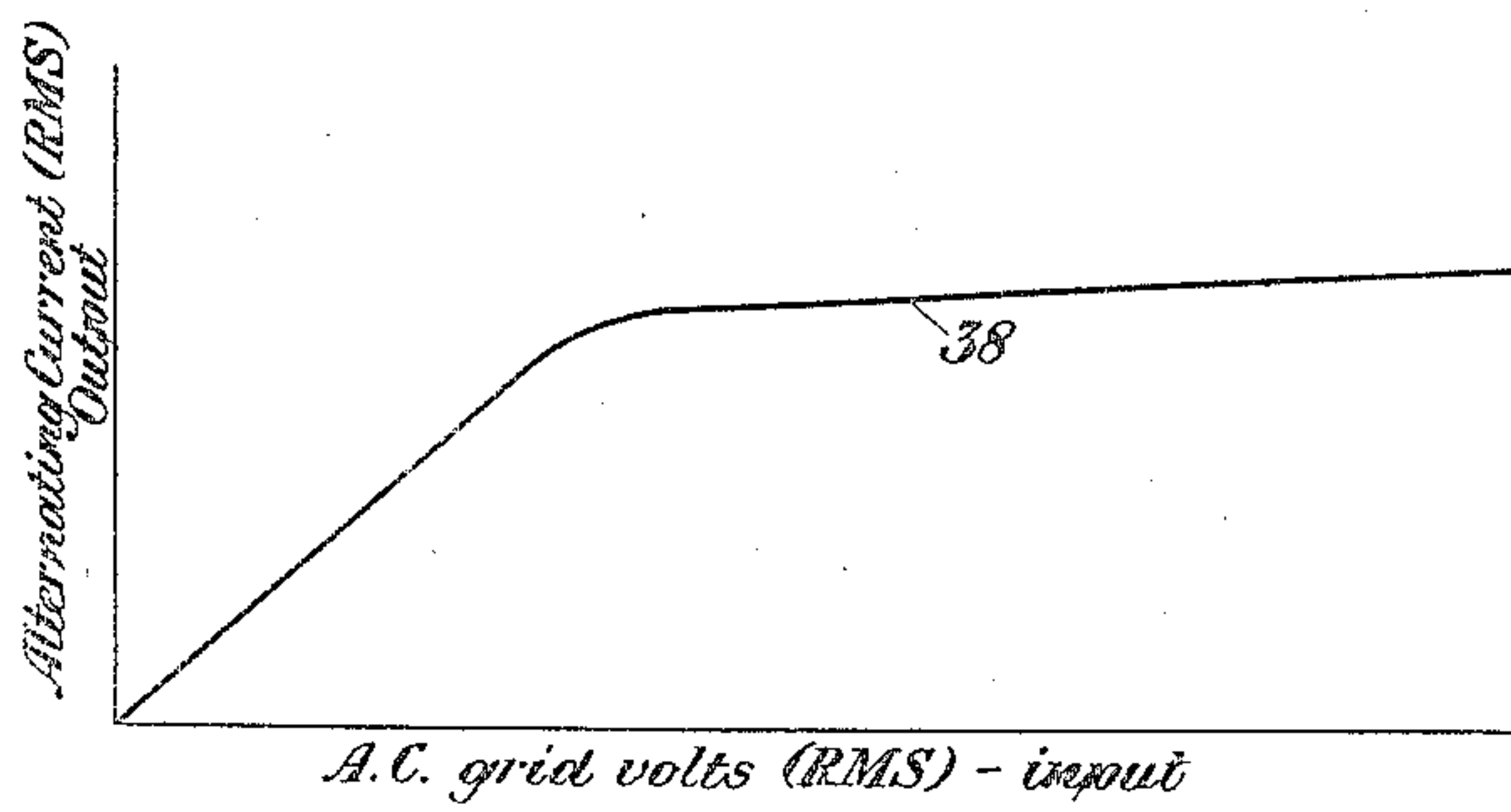
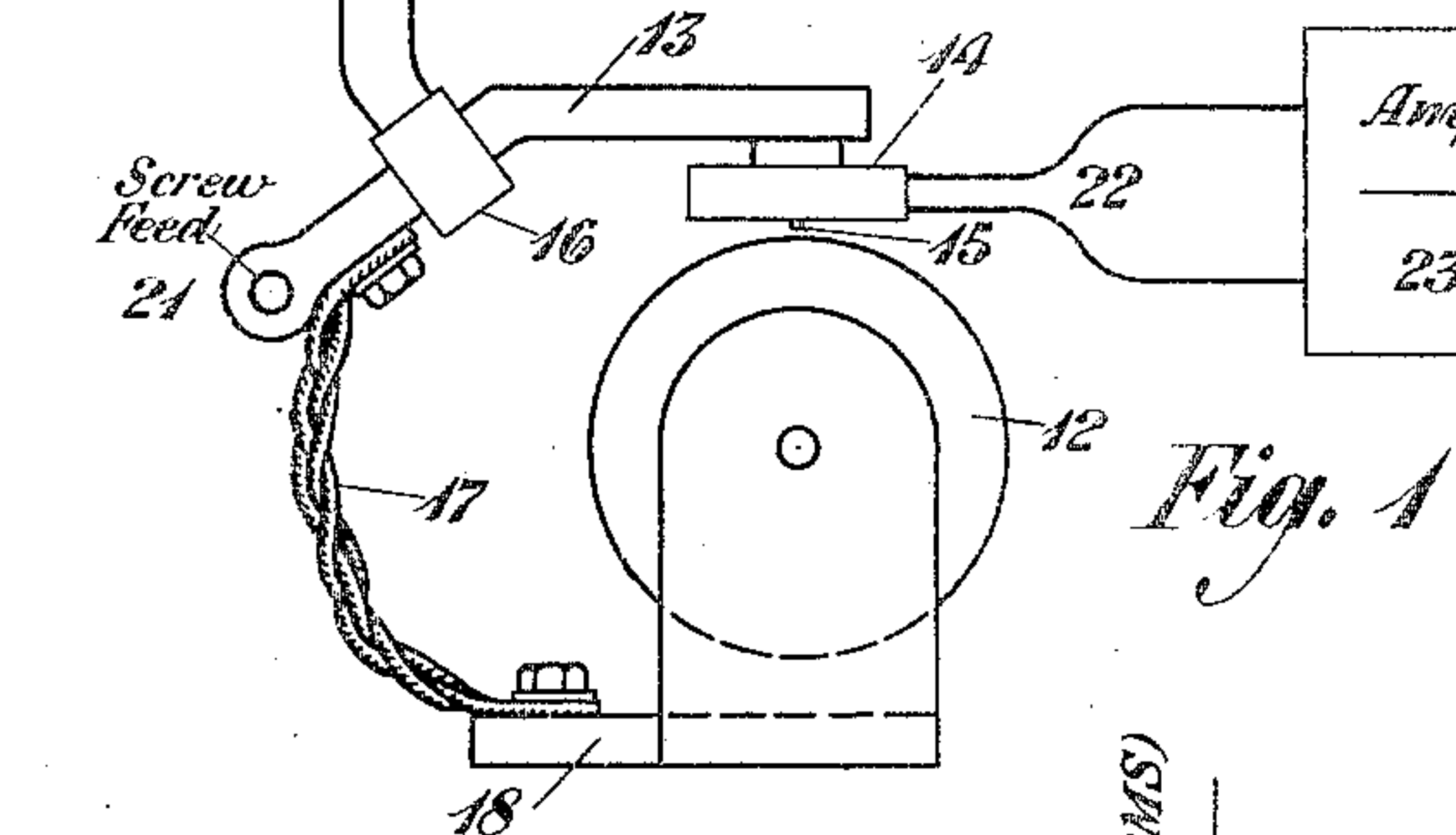
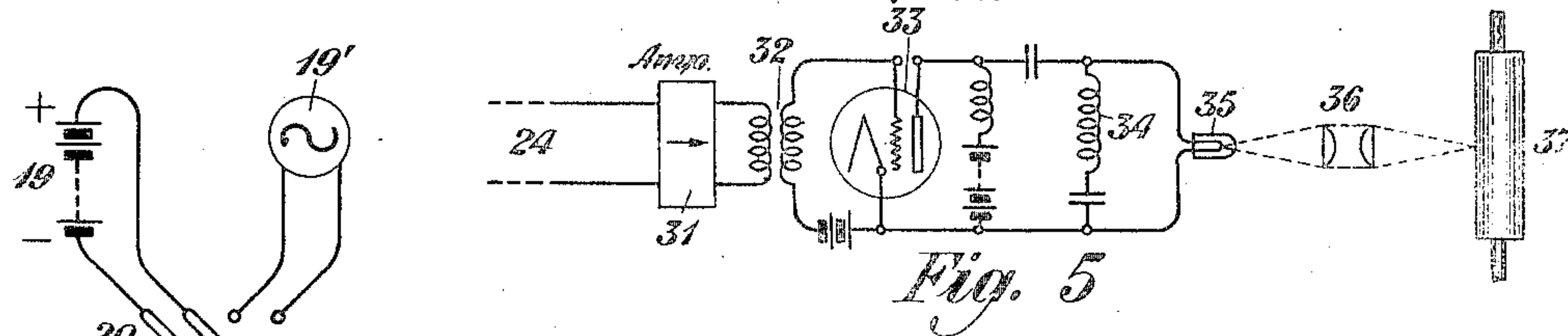
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P. MERTZ

ELECTRICAL TRANSMISSION OF PICTURES

Filed Jan. 26, 1923



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UNITED STATES PATENT OFFICE.

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ELECTRICAL TRANSMISSION OF PICTURES.

Application filed January 26, 1923. Serial No. 615,071.

To all whom it may concern:

Be it known that I, PIERRE MERTZ, residing at 301 Bryant Avenue, Ithaca, in the county of Tompkins and State of New York, have invented certain Improvements in Electrical Transmission of Pictures, of which the following is a specification.

It is an object of my invention to provide new and improved methods and apparatus for transmitting a picture electrically. Another object of my invention is to provide methods and means for impressing upon a transmission line an electric current modified in accordance with the elements of a picture. Another object is to prepare and use a picture film of magnetically permeable material locally modified in accordance with the lights and shades of the picture. These and various other objects of my invention will be made apparent on consideration of a limited number of examples of practice according to the invention, which I will disclose in the following specification. It will be understood that the specification will relate specifically to these examples and the invention will be defined in the appended claims.

Referring to the drawings, Figure 1 is a general diagram of picture transmitting apparatus made in accordance with my invention; Fig. 2 is a detail of Fig. 1; Fig. 3 is a detail modification; Fig. 4 is a diagram of modified transmitting apparatus; Fig. 5 is a diagram of receiving apparatus to go with the transmitting apparatus of Fig. 4; and Figs. 6 and 7 are curve diagrams that will be referred to in explaining the operation of the apparatus of Fig. 5.

The picture is taken in the usual way on a negative with ruled lines, and then a print is made on a gelatine film treated with potassium bichromate or other suitable agent and holding iron-dust in suspension throughout the gelatine. After this gelatine and iron-dust film has been exposed, it is washed with water. The film is rendered insoluble in water by exposure to light and accordingly, the washing process dissolves it away where it has not been exposed and leaves it standing where it has been exposed, and for intermediate degrees of exposure, the gelatine will be washed away in corresponding intermediate degree. The usual precautions are practiced to prevent under-cutting the residual

parts of the film. Thus a film will be obtained with alternate ridges and troughs corresponding to the ruling on the negative, and the ridges will vary in height according to the lights and shades of the picture. This film prepared in this way is shown in section at 11 in Fig. 2. It is mounted on an iron drum 12 with the ridges and troughs parallel to the axis of the drum.

The iron arm 13 has a small projection 15 that stands close to the film 11. As the drum 12 is rotated, the arm 13 is traversed lengthwise of the drum 12 by a screw-feed indicated but not shown at 21. A magnetic circuit for the arm 13 is completed by means of the braided iron wire 17 connected to the iron base 18 which supports the drum 12, so that the only air-gap in this circuit is between the projection 15 and the drum 12.

A coil 16 on the arm 13 supplied by direct current from the battery 19 through the switches 20 establishes a definite magnetomotive force in the magnetic circuit already pointed out. But as the drum 12 rotates under the projection 15, the portion of the film 11 passing under the projection 15 varies in thickness, and since this film 11 is densely impregnated with iron-dust, the reluctance of the air-gap between projection 15 and drum 12 varies accordingly. It results that the magnetic flux in the projection 15 varies in the same way and this induces a variable alternating current in the coil 14 around the projection 15. The higher the ridges of the film 11, the greater will be the intensity of the alternating current induced in the coil 14, and thus the intensity of the alternating current will correspond with the degree of light or shade of the picture in the part under the projection 15.

As the drum 12 rotates, the arm 13 is traversed slowly so that the projection 15 follows a helix with close turns on the cylindrical film 11. In this way the whole area of the picture is traced over and for each elemental part of it an alternating current is put on the conductors 22 corresponding in intensity to the degree of light or shade of the successive parts of the picture.

The current generated in the coil 41 goes over the conductors 22 to the amplifier 23 and the amplified current is put on the line 24 for transmission to the receiving station.

Instead of using a ruled negative, the rulings may be omitted, in which case the gelatine-iron-dust film will have the form shown in cross-section at 11' in Fig. 3. In this case the switches 20 are thrown and the coil 16 is fed with alternating current from the source 19'. This alternating current will be modulated in accordance with the thickness of the film 11' passing under the projection 15, and the modulated alternating current will be delivered by the conductors 22 to the amplifier 23, whose output will then go to the line 24.

In the modification of the transmitting apparatus shown in Fig. 4, the coil 14 of Fig. 1 is made an element of the oscillation circuit of an audion-oscillator comprising the tube 29 and the battery 30. In this case the switches 20 are opened and the coil 61 stands on open circuit. The oscillating circuit in which the coil 14 is included has the usual inductively related windings 26 and 27 and condenser 25, and the energy is delivered by means of a transformer 28 to the input of the amplifier 23 whose output goes to the line 24.

The varying reluctance of the magnetic circuit for the coil 14 varies its inductance and hence varies the frequency, and therefore the alternating current that is put on the line 24 varies in frequency according to the lights and shades of the successive parts of the picture as the corresponding film passes under the projection 15.

The receiving apparatus for the systems of Figs. 1, 2 and 3 may be of the usual type, the intensity of the received current determining the intensity of a lamp to which a sensitive film is exposed in synchronism with the transmitting film at its end of the line.

For receiving when frequency modulation is employed as described in connection with Fig. 4, the apparatus shown in Fig. 5 may be used. The received current coming in over the line 24 goes to an amplifier 31 from which the output is taken to a transformer 32 and then to the input of an audion-amplifier 33. This audion 33 has a characteristic curve like that shown in Fig. 6, and the adjustment is such that it is worked at the region 38 on the saturation part of the characteristic. This means that the current intensity is substantially constant even though the input voltage is varied over a certain range, and reception will not be seriously affected by slight changes in the attenuation of the line. The output of the audion 33 is shunted by a tuned circuit 34 whose resonance frequency is a little above or a little below the range of frequencies coming in over the line 24 as determined by the varying inductance of the winding 14. Referring to Fig. 7, the curve shows the selective peak for the tuned circuit 34 and the frequency range of the received current will

lie between 39 and 40 or between 41 and 42. Accordingly, the output current from the audion 33 will be shunted at 34 more or less according to its frequency, and the current that goes to the lamp 35 will vary accordingly. Thus the intensity of the light emitted from the lamp 35 will depend on the frequency of the current and will correspond to the lights and shades of the transmitted picture.

The light from the lamp 35 is focused by the lenses 36 on a point of the surface of the drum 37 which carries the sensitive receiving film. The drum 37 is rotated and traversed in synchronism with the rotation of the sending drum 12 and the traverse of the magnetic arm 13, so that the print made on the drum 37 corresponds point for point with the transmitted picture.

I claim:

1. The method of transmitting a picture which consists in modulating a current in accordance with the magnetic property of a film in which such property has been developed in correspondence with the lights and shades of the picture.

2. A film comprising magnetically permeable material modified locally in accordance with the lights and shades of a picture.

3. A picture film comprising magnetically permeable material whose thickness at each point corresponds to the degree of light at that point in the picture.

4. A picture film comprising material whose reluctance for magnetic flux corresponds at each point to the degree of light at that point in the picture.

5. In combination, a picture film comprising material whose reluctance corresponds at each point to the degree of light at that point in the picture, a magnetic flux path with an air gap, said film lying across said gap, means to move the film, a coil interlinked with said flux path and means to develop an electric current in said coil.

6. The method of transmitting a picture which consists in modifying a sheet of magnetic material in correspondence to the degree of light from place to place in the picture and then causing the parts of the sheet successively to influence a characteristic of an electric circuit so as to produce a corresponding modulated picture sending electric current.

7. A picture film comprising magnetically permeable material with parallel troughs and alternate ridges whose height corresponds at each point with the degree of light at that point in the picture.

8. A picture film comprising magnetically permeable material with parallel troughs and alternate ridges whose height corresponds at each point with the degree of light at that point in the picture and in combination therewith a magnetic flux path

comprising a gap in which the film lies, and means to move the film in a direction across the troughs and ridges and across the axis of said gap whereby the reluctance of said path is varied in regular alternation and to a degree corresponding to the height of the said ridges.

9. In combination, a magnetic flux path having an air gap, a coil linked therewith, a source of energizing current for said coil, another coil linked with said flux path, a picture film in said air gap of permeable material locally modified in accordance with the lights and shades of the picture, and means to move said film across the axis of the air gap, thereby varying the reluctance of the magnetic circuit and inducing a variable current in the second mentioned coil.

10. The method of transmitting a picture electrically which consists in varying the frequency of an alternating current in accordance with the lights and shades of successive points of the picture and receiving this current in an audion which is crowded

so that it operates on the saturation part of its characteristic curve and delivering the output from this audion to a tuned circuit with its resonant frequency a little at one side of the normal frequency range, said tuned circuit having the receiving lamp in parallel therewith.

11. The method of transmitting and receiving a picture electrically which consists in varying the frequency of an alternating current in accordance with the lights and shades of the picture at successive points thereof, and receiving such current on the input side of a vacuum tube adjusted to operate on the saturation part of its volt-ampere characteristic curve whereby the variation in intensity of the output current will be of substantially no effect and the picture reception will be determined by the frequency variation.

In testimony whereof, I have signed my name to this specification this 22nd day of January, 1923.

PIERRE MERTZ.