

No. 763,345.

PATENTED JUNE 21, 1904.

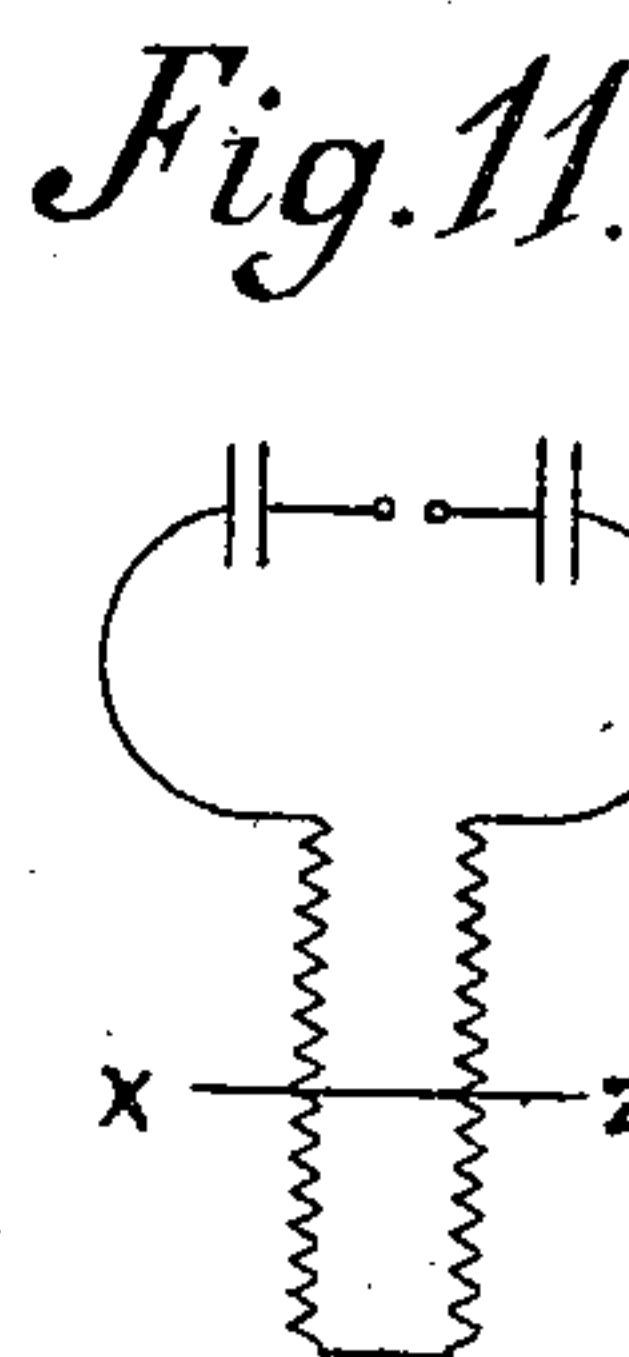
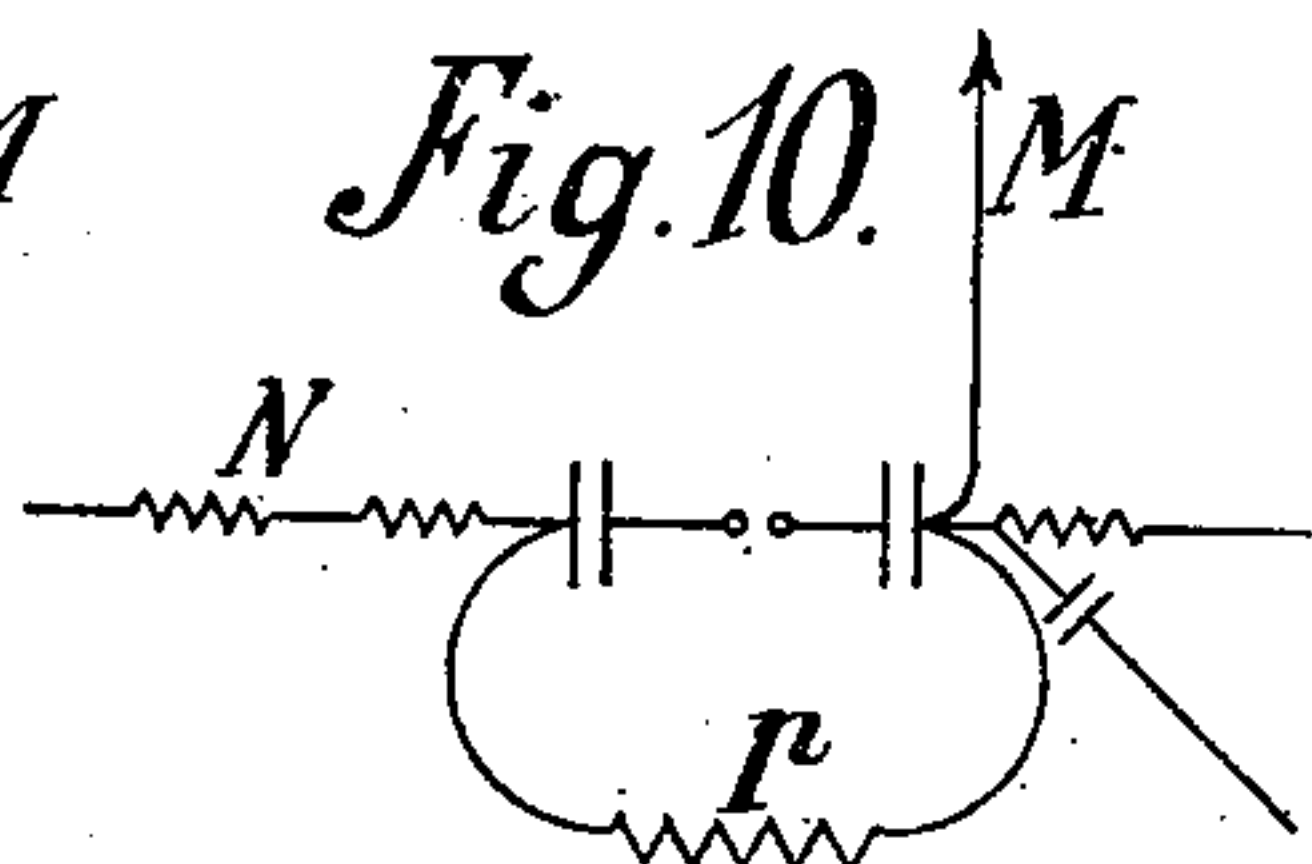
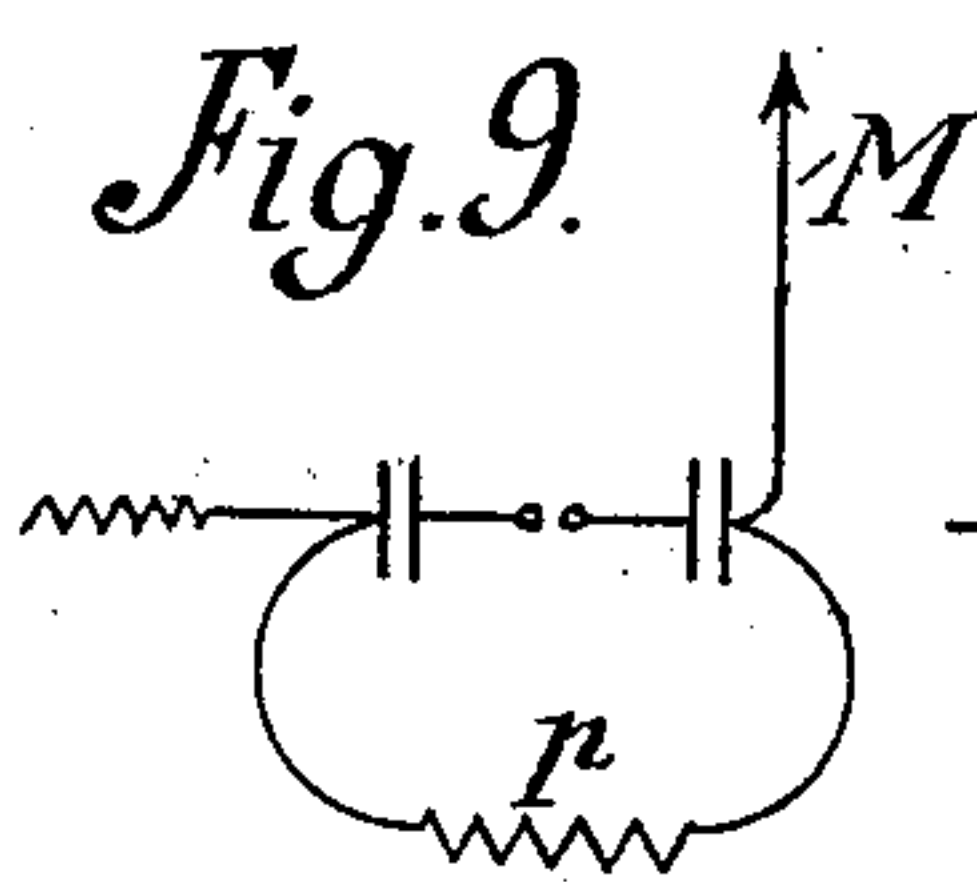
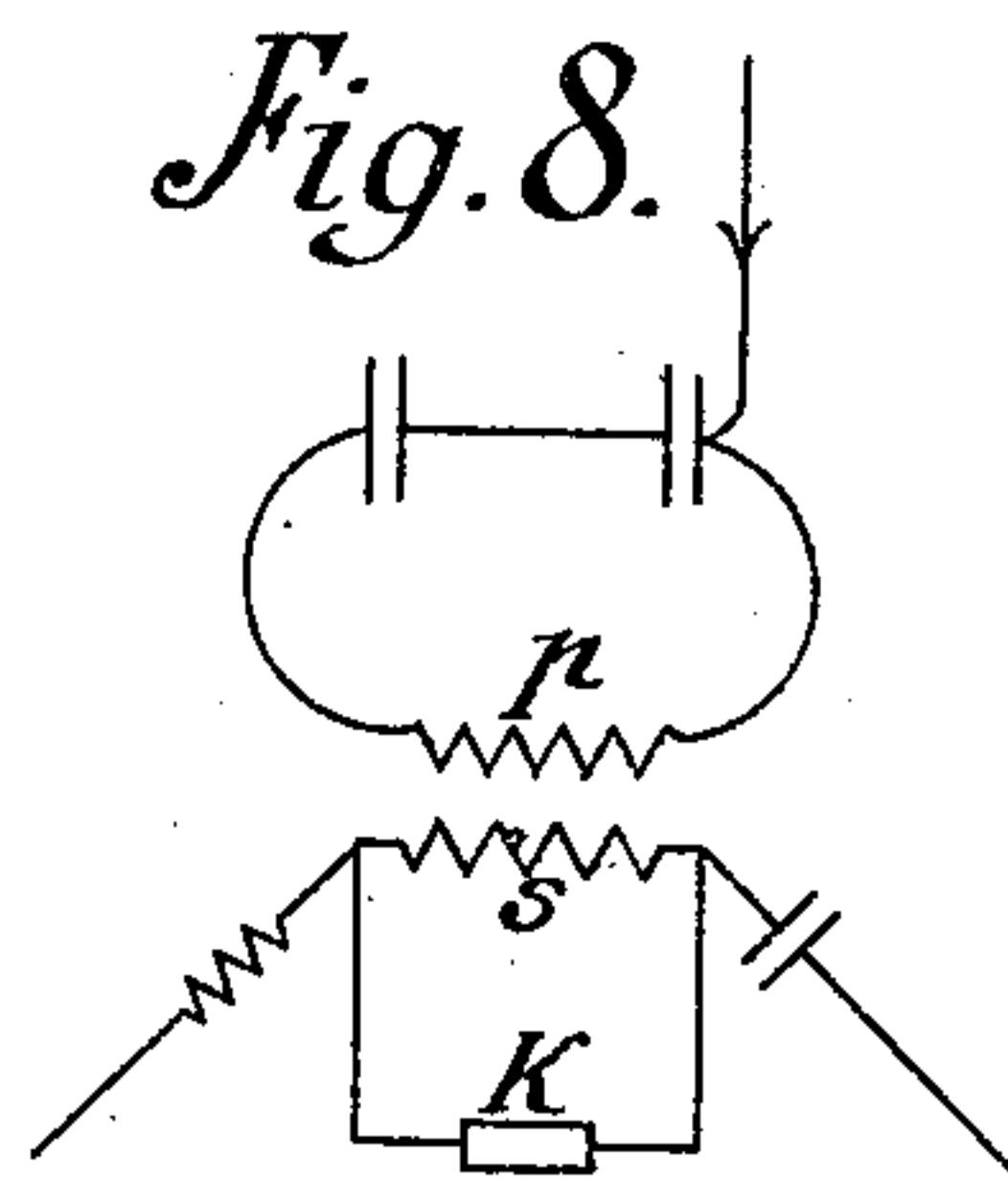
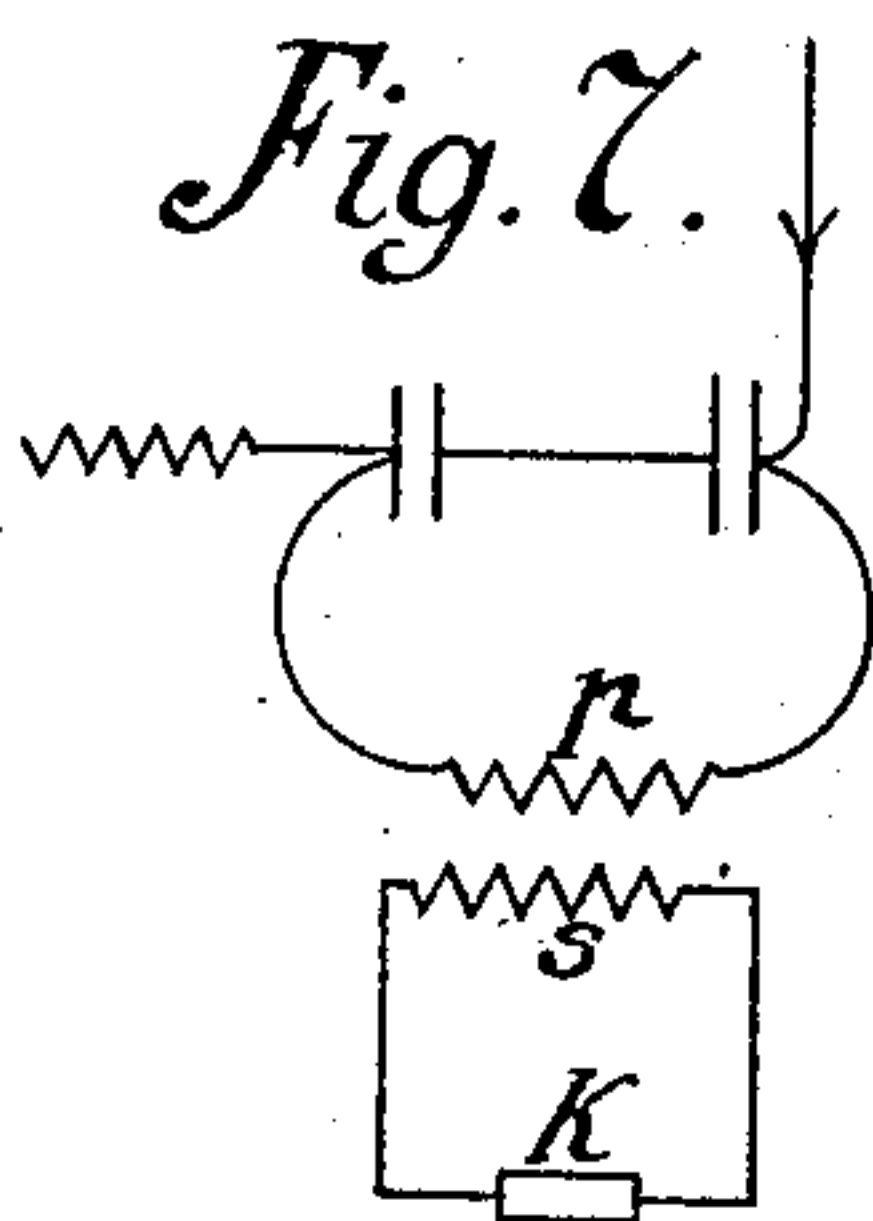
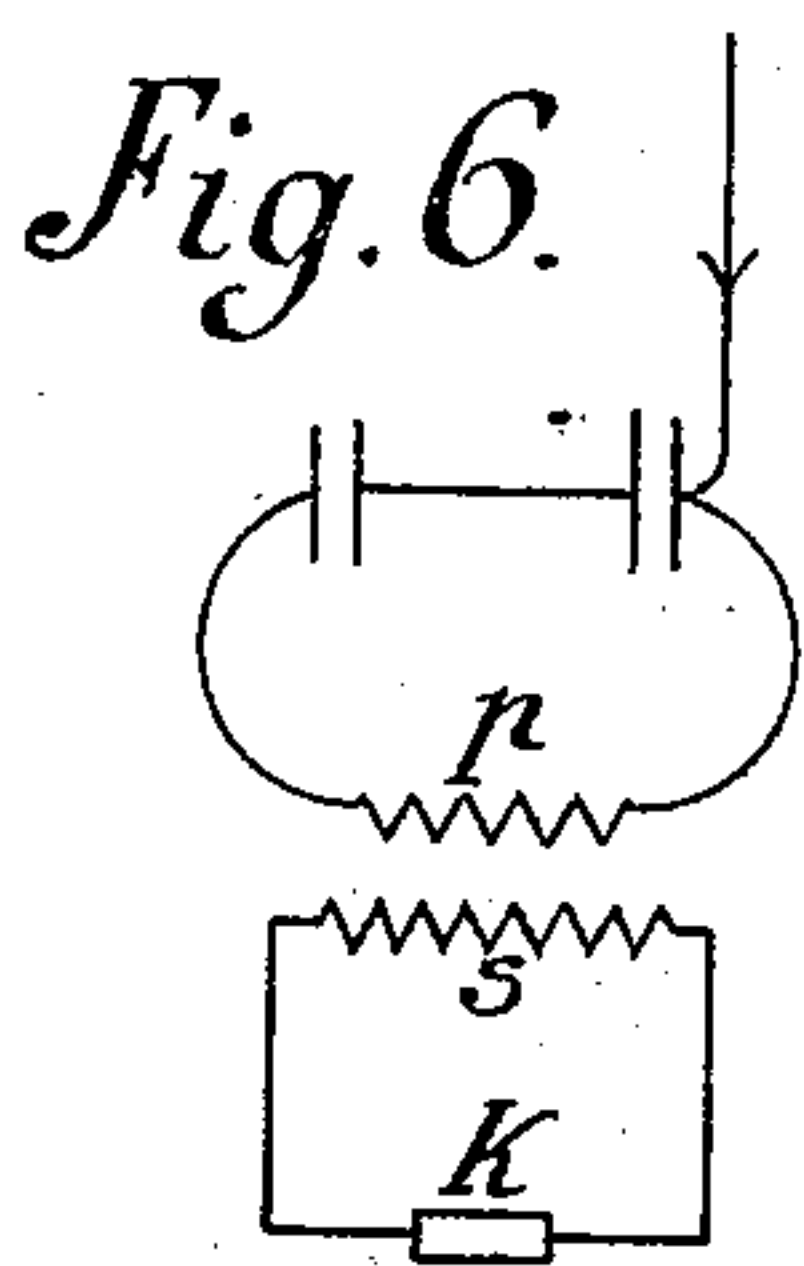
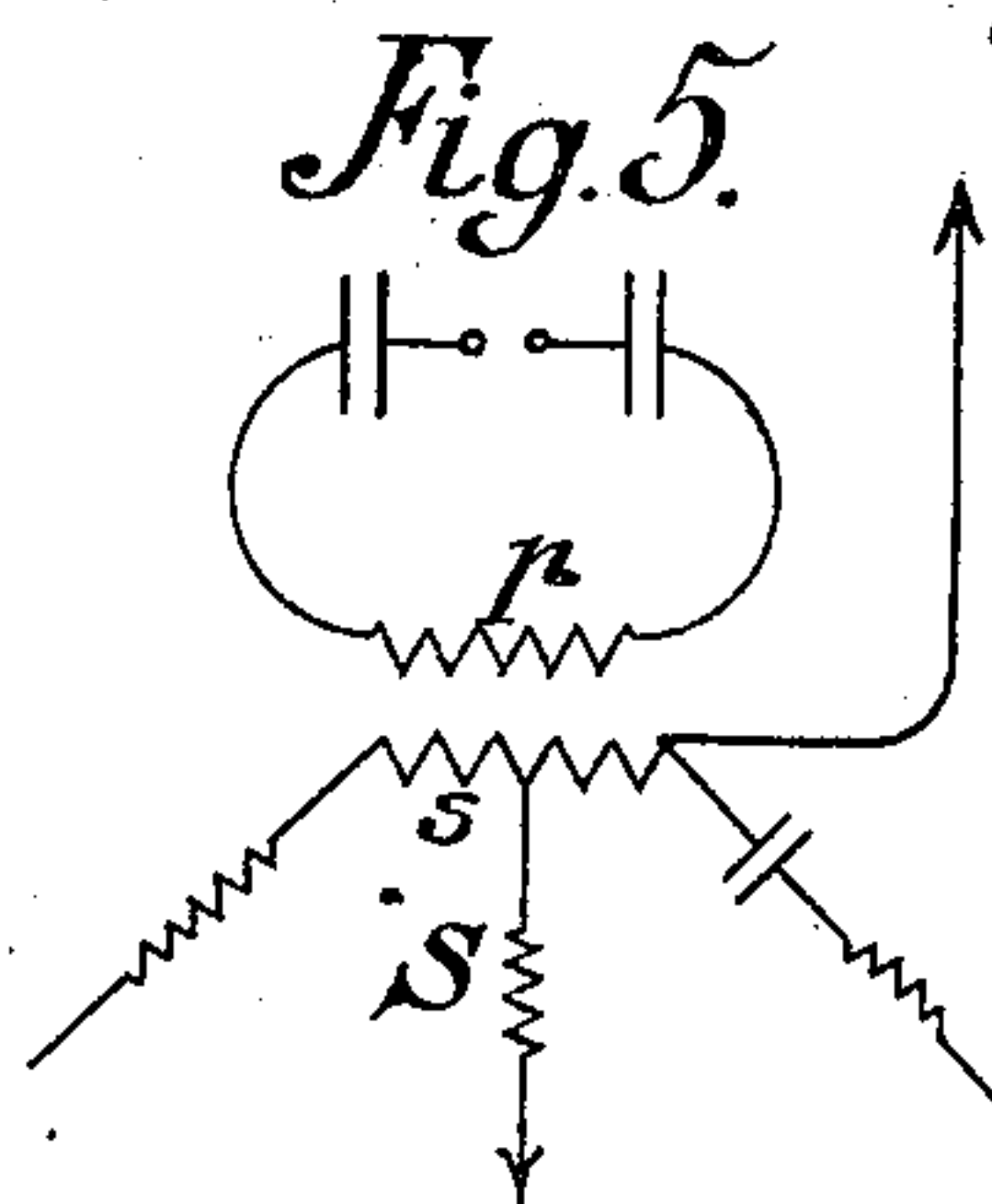
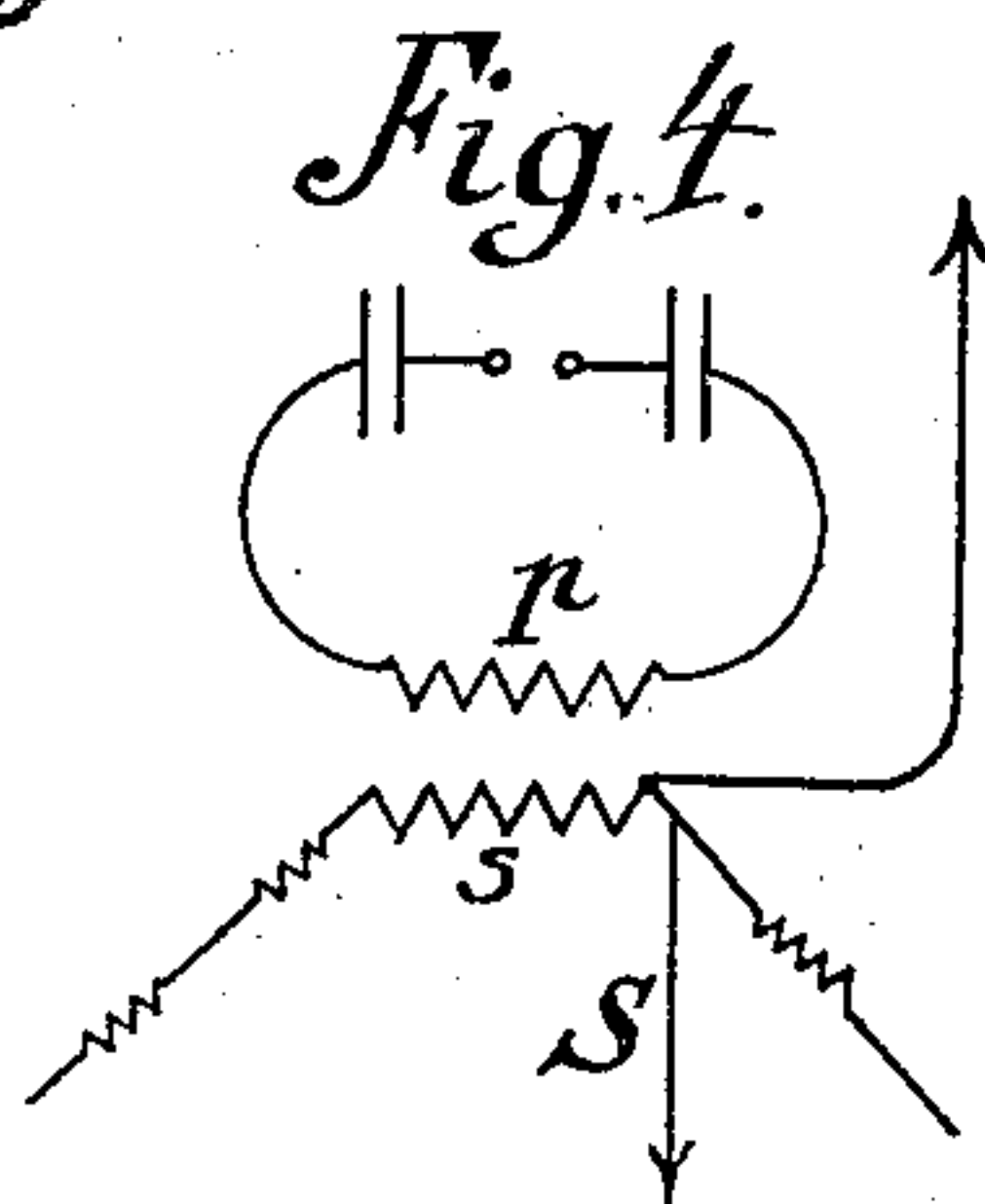
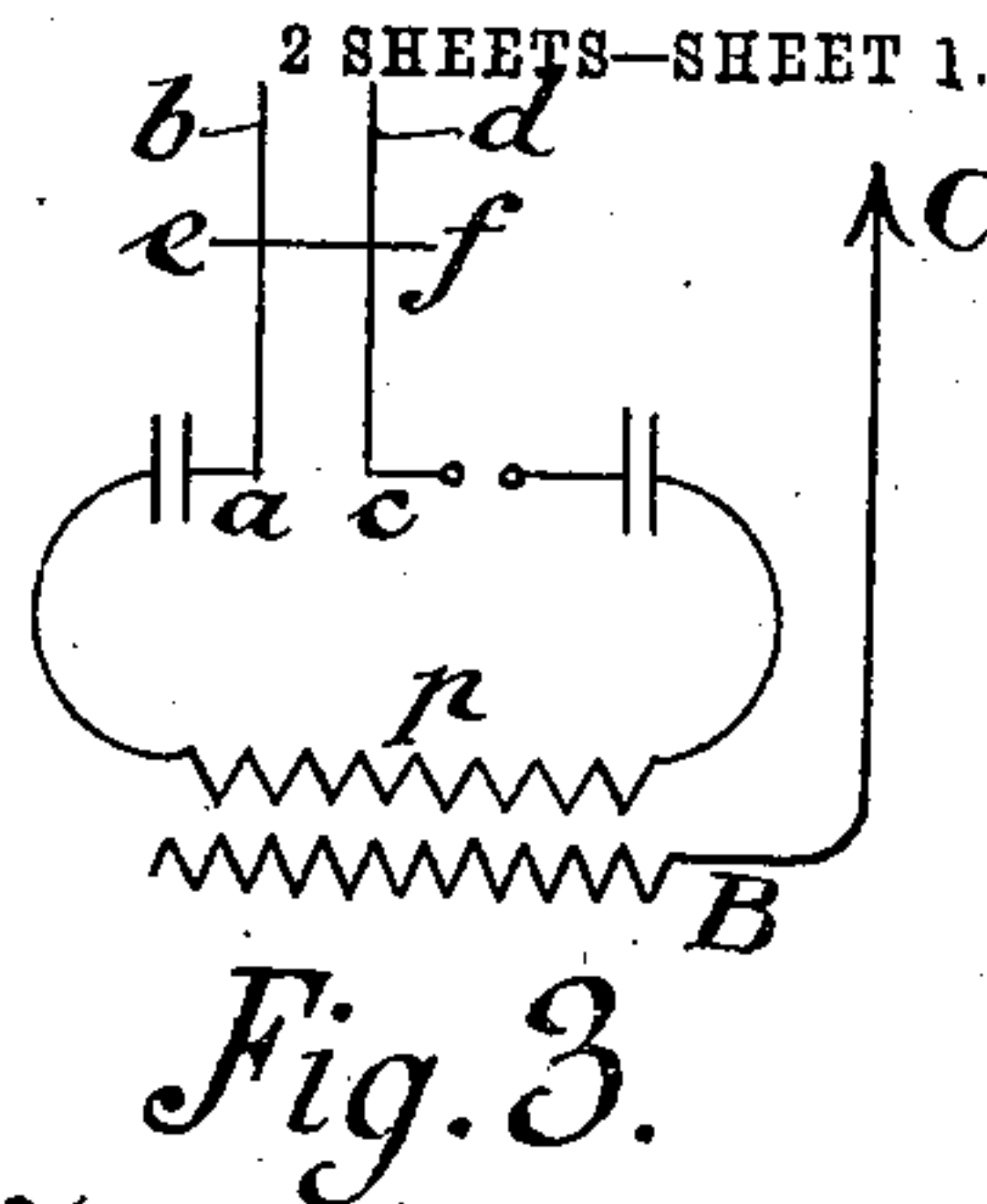
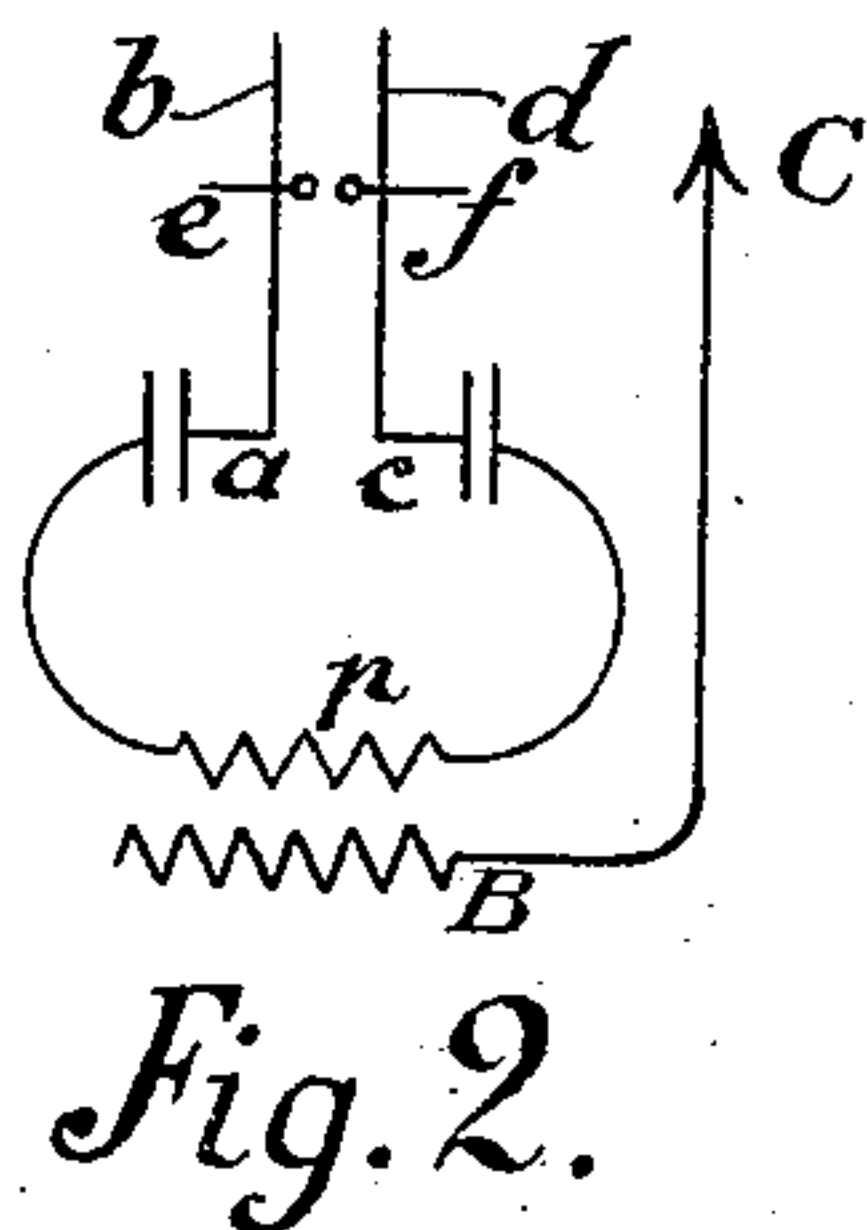
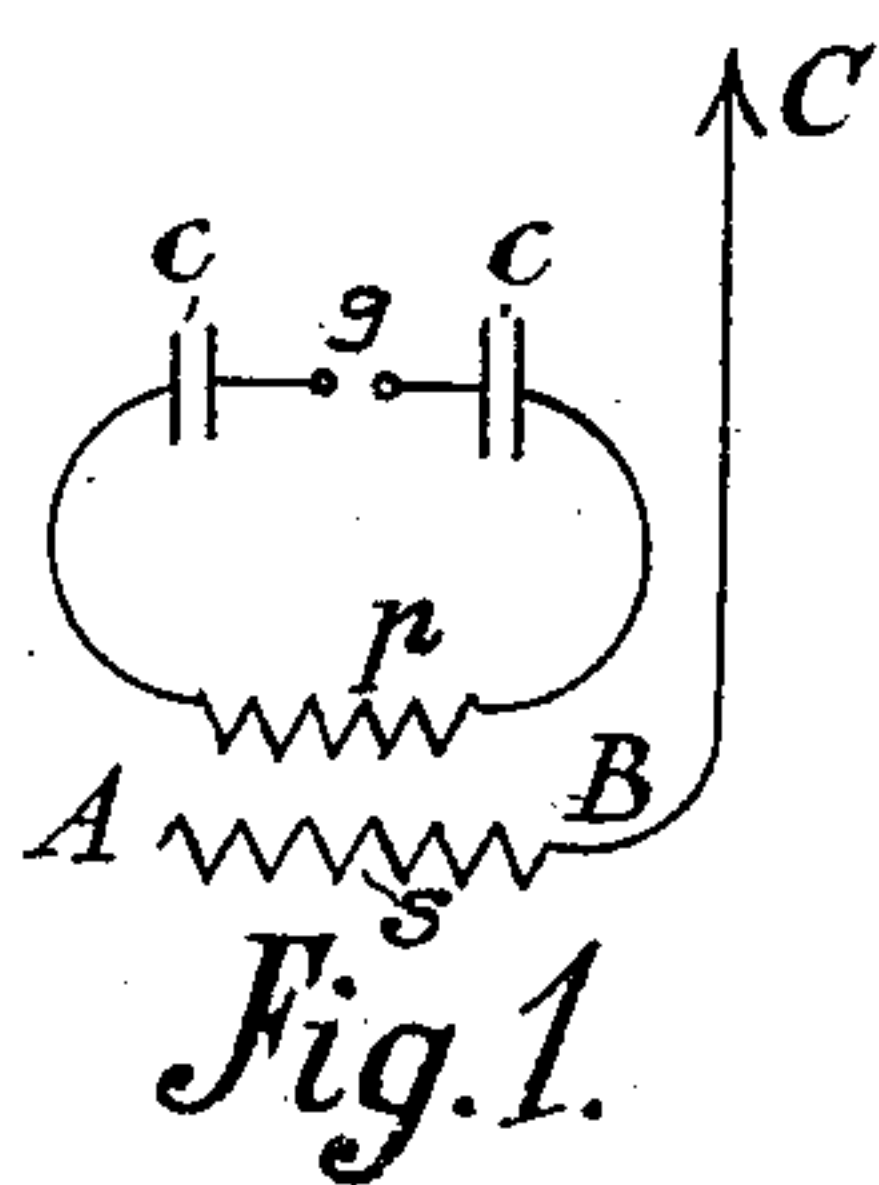
F. BRAUN.

MEANS FOR TUNING AND ADJUSTING ELECTRIC CIRCUITS.

APPLICATION FILED AUG. 5, 1901.

NO MODEL.

2 SHEETS—SHEET 1.



Attest:  
D. F. K. Hoe  
A. W. Bourke.

by

Inventor  
Ferdinand Braun  
Philip Sanger Rice Kennedy  
Attys

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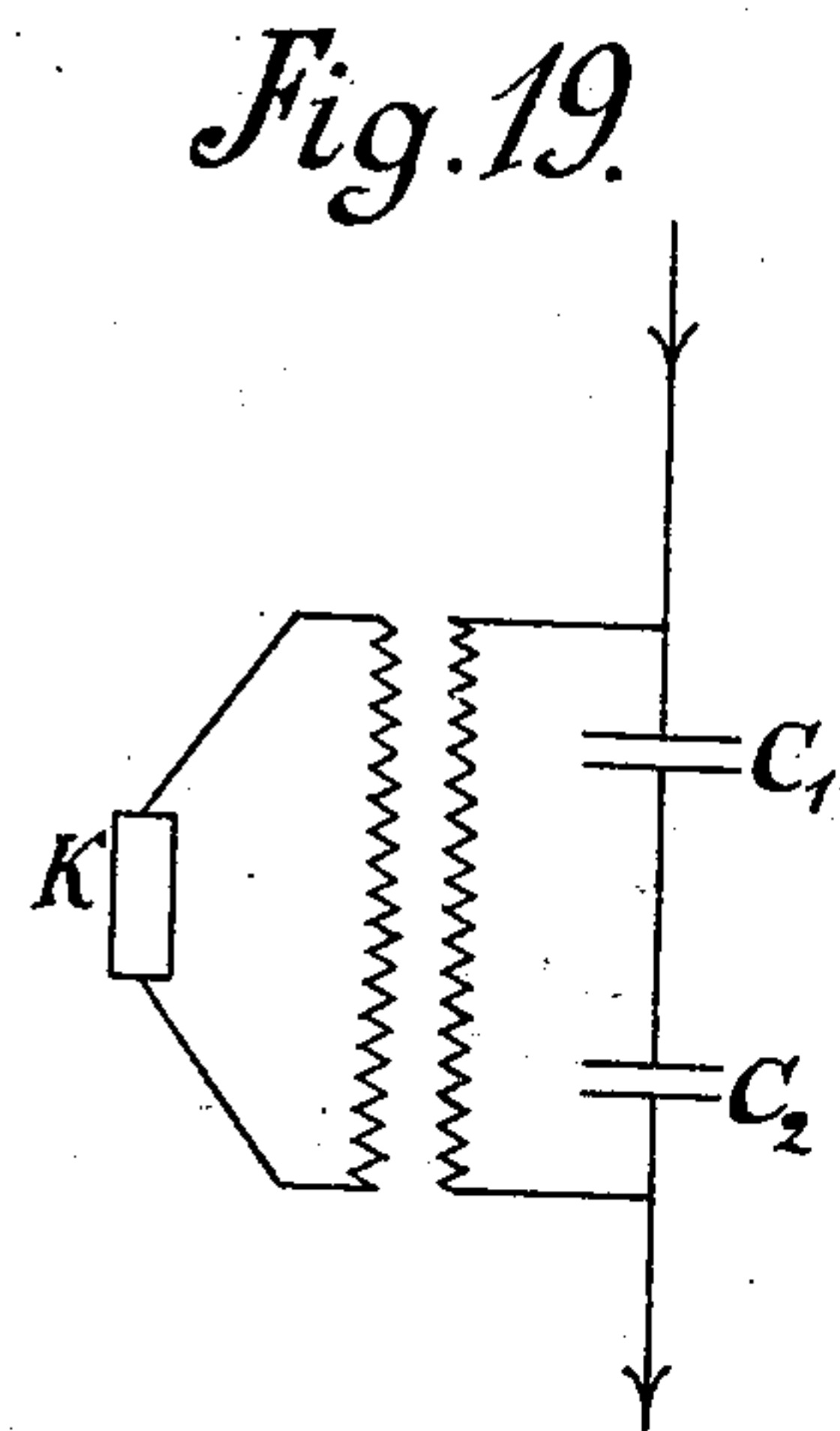
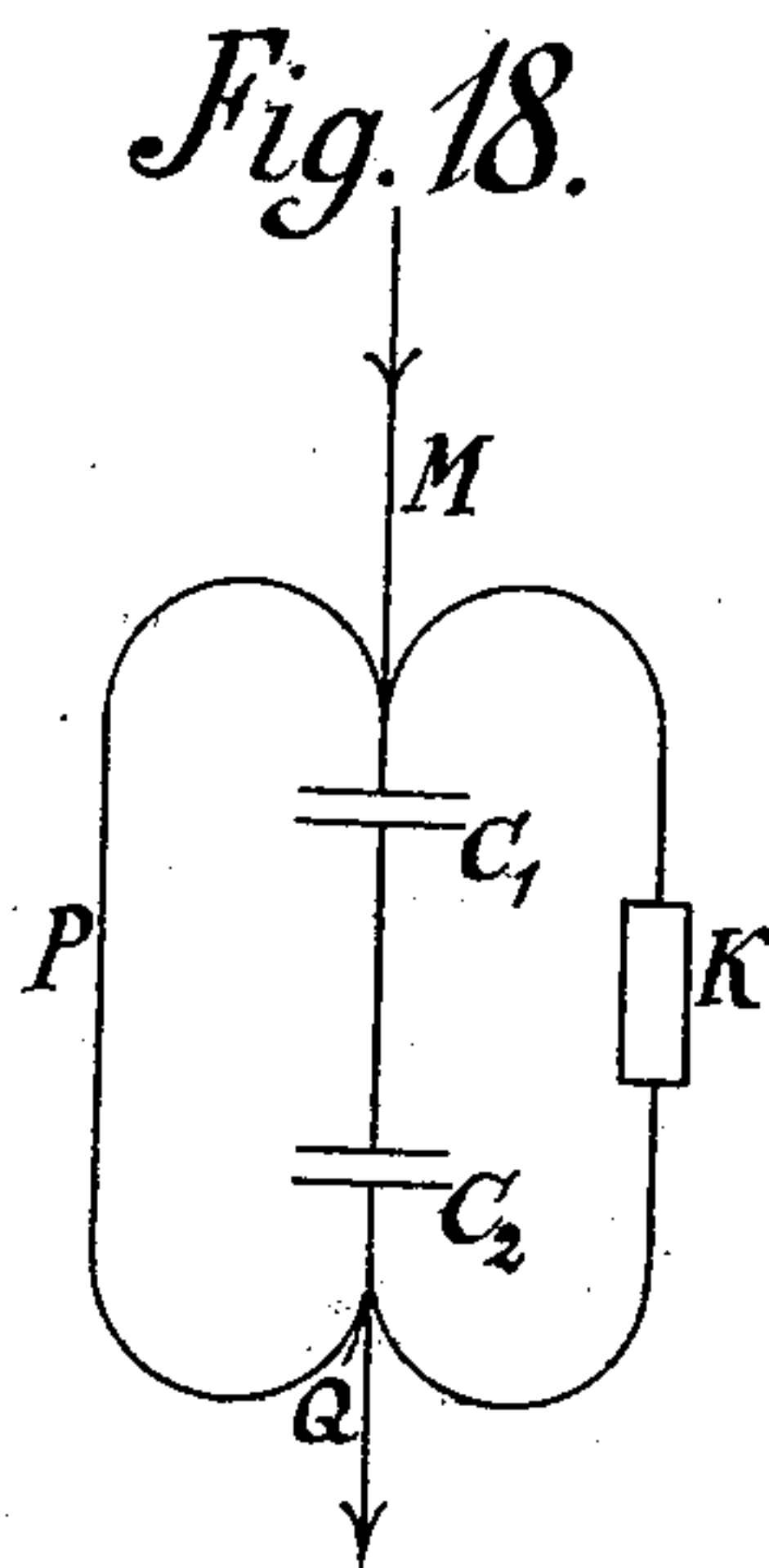
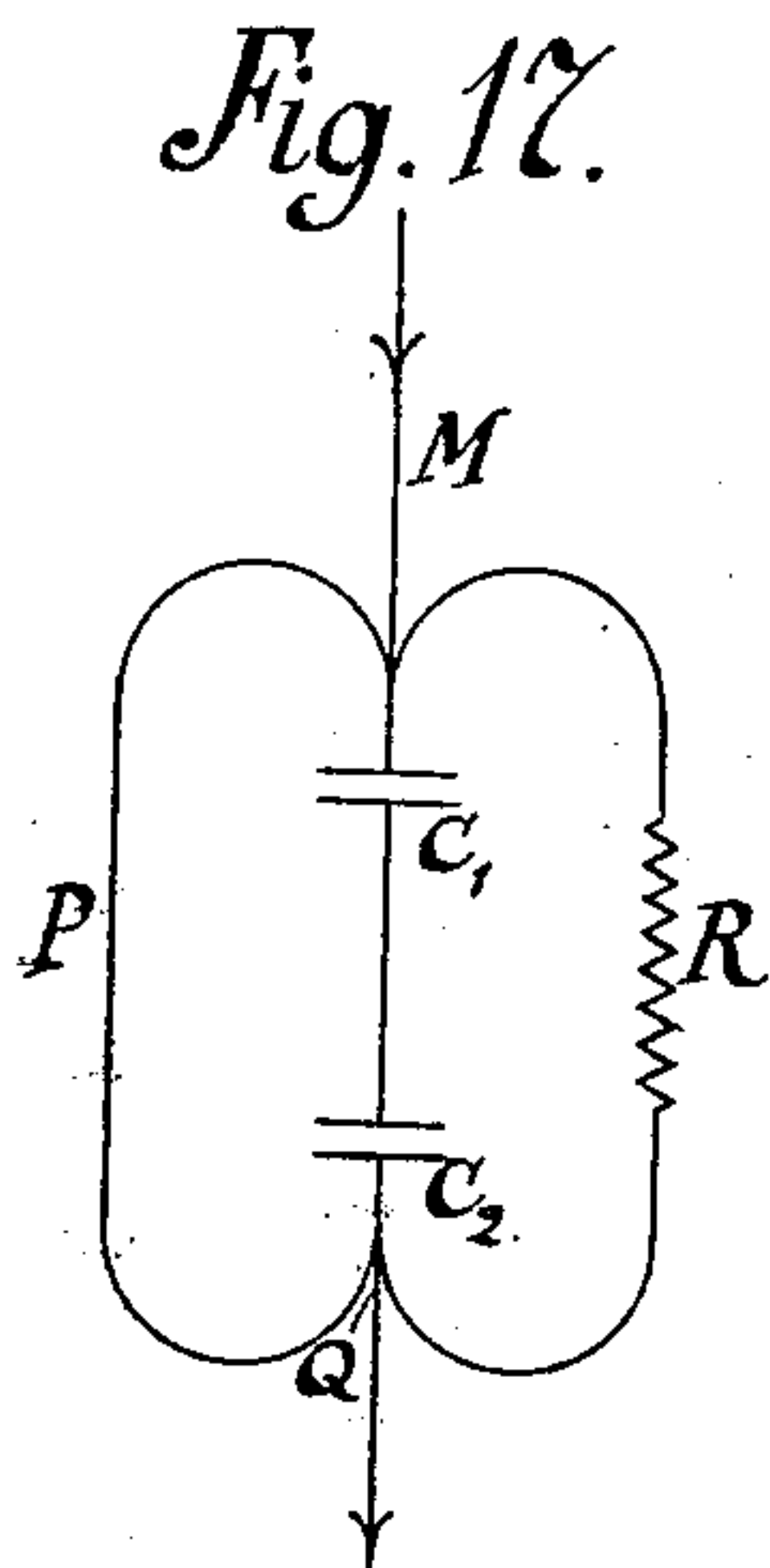
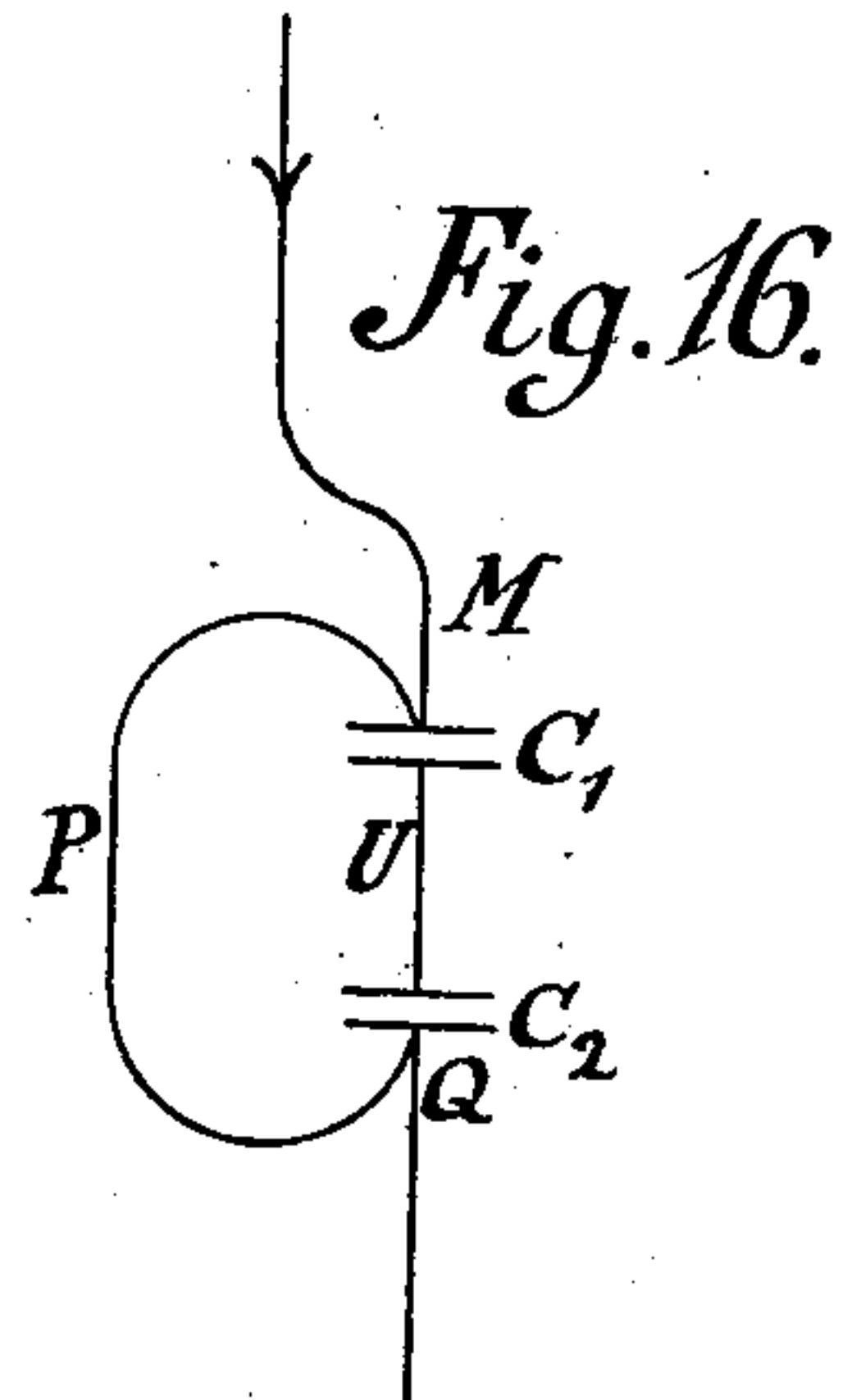
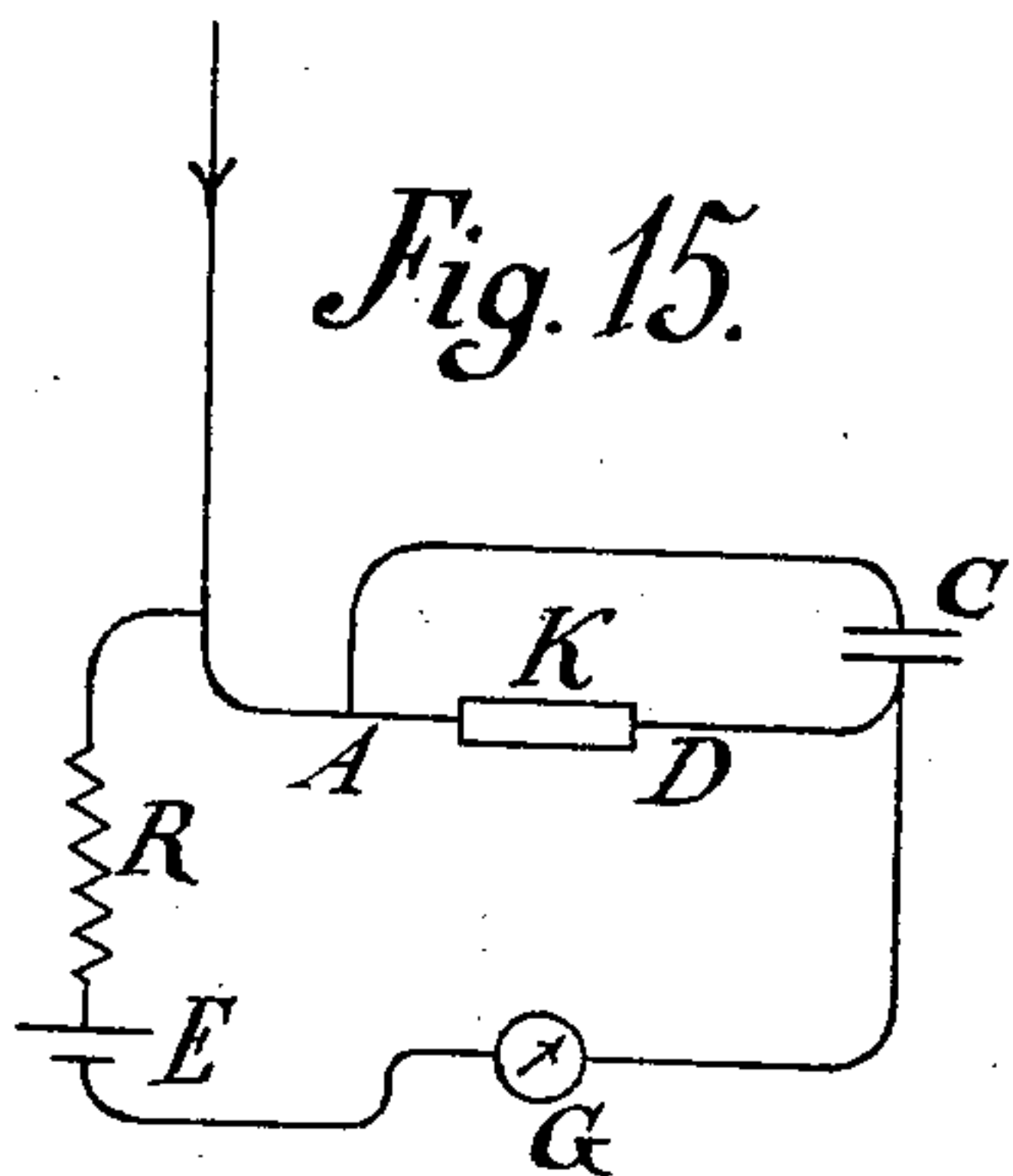
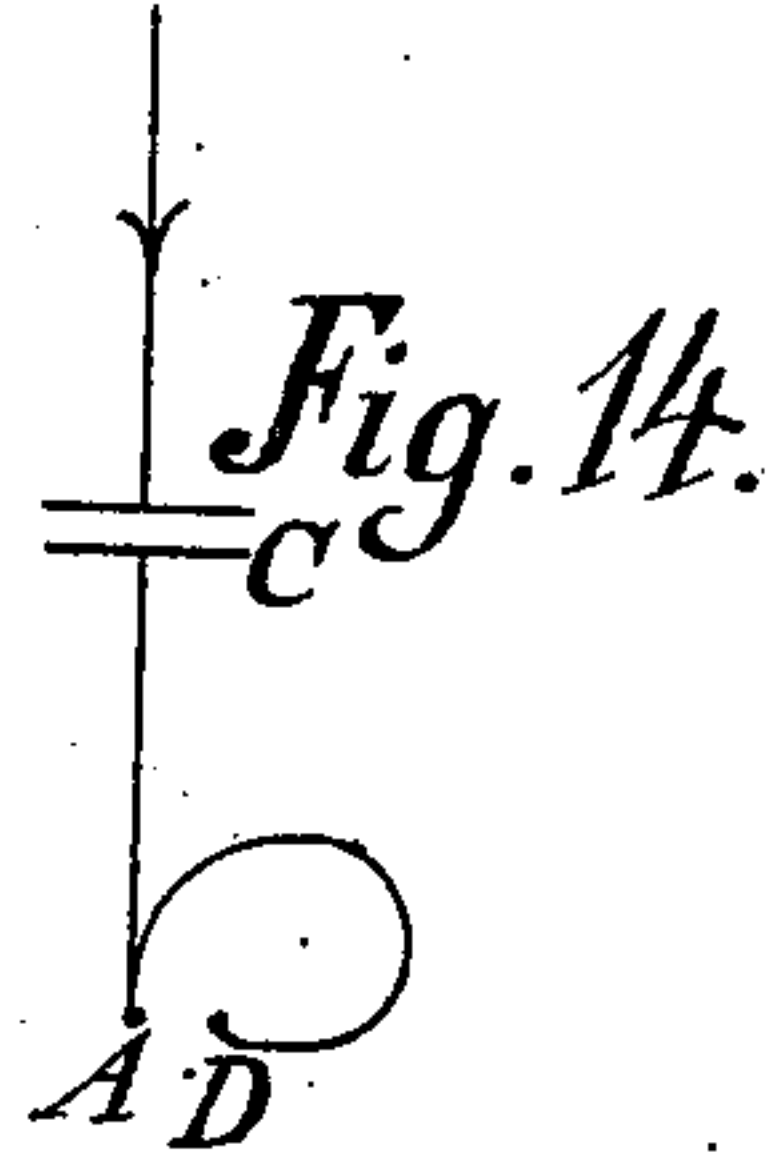
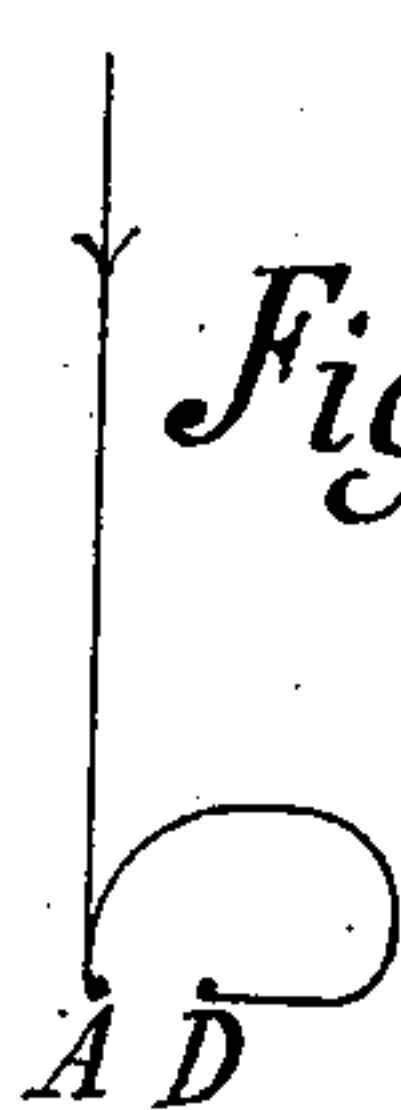
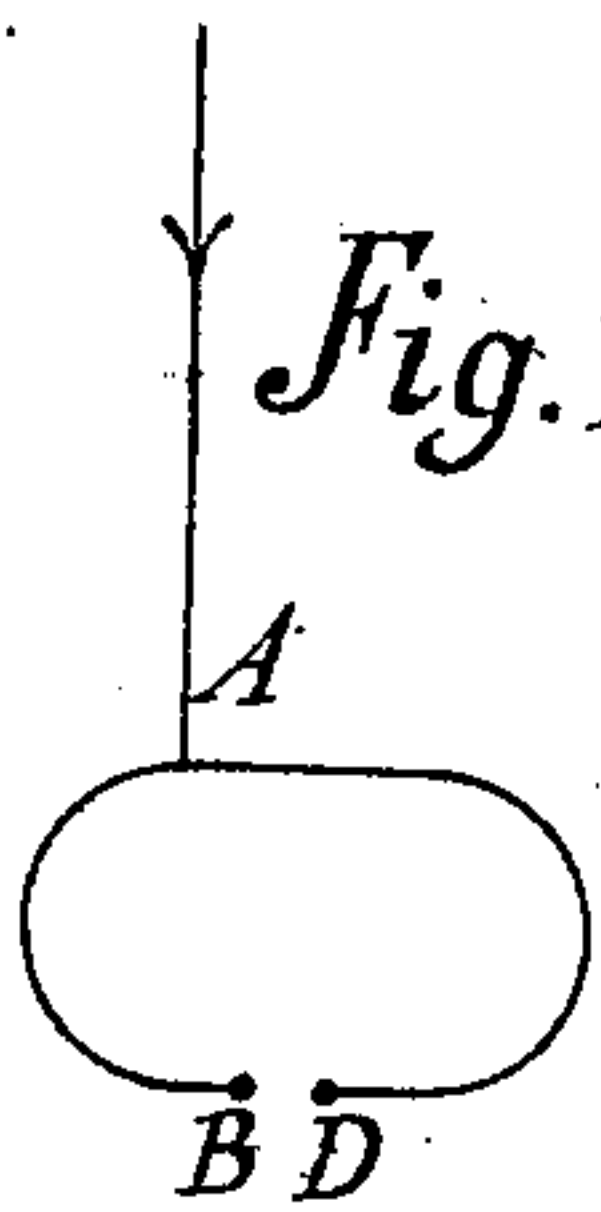
F. BRAUN.

MEANS FOR TUNING AND ADJUSTING ELECTRIC CIRCUITS.

APPLICATION FILED AUG. 5, 1901.

NO MODEL.

2 SHEETS—SHEET 2.



*Attest:*  
*T. F. Schoe*  
*A. H. V. Bourke*

*Inventor:*  
*Ferdinand Braun*  
*by* *Philipp Samyer Rice & Kennedy*  
*Attys*



## UNITED STATES PATENT OFFICE.

FERDINAND BRAUN, OF STRASBURG, GERMANY.

## MEANS FOR TUNING AND ADJUSTING ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 763,345, dated June 21, 1904.

Application filed August 5, 1901. Serial No. 71,009. (No model.)

*To all whom it may concern:*

Be it known that I, FERDINAND BRAUN, a subject of the Emperor of Germany, and a resident of Strasburg, Alsace, German Empire, have invented certain new and useful Improvements in Means for Tuning and Adjusting Electric Circuits; and I do hereby declare that the following is a full, clear, and exact description of my invention, which will enable others skilled in the art to which it appertains to make and use the same.

It is known that wireless telegraphy may be made more effective by tuning the electric primary and secondary circuits of the sending and receiving instruments.

The object of the present invention is to improve such tuning.

In accordance with the invention the tuning may be accomplished by adding or inserting certain pieces or coils of wire, the length of which is determined by calculation or experiment.

Apparatus for practicing the invention is illustrated diagrammatically in the accompanying drawings, in which—

Figure 1 shows connections such as are now used for transforming electricity in the transmitter for wireless telegraphy. Figs. 2, 3, 4, and 5 illustrate different ways of modifying such apparatus for the purpose of practicing my invention. Figs. 6, 7, and 8 show the application of the invention to a wireless-telegraph receiver. Figs. 9, 10, and 11 illustrate other applications of the invention to a transmitter. Figs. 12, 13, and 14 illustrate apparatus for practicing the invention by the use of resonators. Fig. 15 shows more fully the electrical connections for a receiver; and Figs. 16, 17, 18, and 19 show other applications of the invention, which will be referred to.

In Fig. 1, which indicates a known form of wireless-telegraphy transmitter, the primary circuit includes the spark-gap *g*, the condensers *cc*, and the primary coil *p* of the transmitter. The secondary coil is represented by *s*, and *BC* is the transmitting or sending wire. In order to increase the capacity in accordance with my invention, pieces of wire either in straight form or in form of coils are

inserted or added—as, for example, as shown in Figs. 2 to 5.

In Fig. 2 the spark-gap is moved from the position *ac* to the position *ef*, thereby adding the lengths of wire *ab* and *dc* to the circuit.

Fig. 3 shows a modification of the arrangement shown in Fig. 2, in which the spark-gap is removed from the position *ac*, and the wires *ab* and *dc* are connected by a bridge *ef*, which may be moved in either direction for adjusting the oscillation-circuit, thereby altering the capacity, and consequently the energy. The circuit should be adjusted so that this capacity will be a maximum.

If the transmitter has been given its maximum of capacity by this means, the action may be further increased by adding to the free end *A* of the secondary coil *s* additional pieces of wire either in straight or coil form. (See Figs. 4 and 5.) These pieces may advantageously contain induction-coils and condensers, and are characterized by the fact that a certain number of windings give the maximum of capacity, which will be diminished both by increasing or diminishing the number of windings.

Figs. 6, 7, and 8 show the application of the invention to receivers for wireless telegraphy. In Fig. 7 a compensating coil is added to a primary circuit. This connection avoids the necessity of earthing. Fig. 8 shows additional pieces joined to the secondary circuit of the receiver.

Fig. 9 shows an arrangement whereby the symmetry destroyed by the action of the sending-wire *M* may be restored by adding a compensating coil at the opposite side of the condensers, and Fig. 10 shows a further carrying out of this idea. The coil *p*, as shown in these figures, acts as an inductance-coil. In certain cases—as, for example, in the practice of wireless telegraphy in connection with moving objects, as ships or balloons—it is preferable to provide adjusting means to avoid asymmetric action, as by means of the bridge *xx*. Earth connection may be provided, as shown in this figure.

A preferred form of the additional pieces



is a form of resonator, the nature of which has been discovered by Hertz and his followers. A receiving apparatus employing a resonator is illustrated in Fig. 12. In the apparatus shown in this figure the electric wave passing down the receiving-wire is branched at A in two directions, AB and AD. If now the length of the two wires AB and AD is such that the difference is equal to one-half the length of the waves, the point BD will be in a phase difference of one hundred and eighty degrees. In the resonator a system of waves is produced rising up to a certain maximum. BD are peaks of the waves, so far as electric oscillations are concerned. An earth connection would therefore disturb the condition of resistance and be of no use. For the same reason no capacity is to be added to either of the ends B or D. The most simple arrangement is to make the length AB equal to zero, Fig. 13. Adding capacity, as by condenser C, in the sending-wire will not disturb the effect of the resonator, Fig. 14. The wave generated in the circuit AD is capable of producing induction in any circuit in its neighborhood.

Referring to Fig. 15, K represents a coherer or its equivalent; R, an inductive resistance; E, an element of a battery; G, a galvanometer or its equivalent, and C the condenser.

In using closed oscillation-circuits an arrangement may be employed, as shown in Fig. 16, where the end of the receiving-wire is connected to two condensers  $C^1$   $C^2$ , which are joined by the circuit MPQ, the connection between the two condensers being marked U. One condenser may be used instead of two; but the use of two condensers is preferable, for the reason that the necessary adjustment is thereby made easier. The oscillations in closed circuits are much less sensitive to disturbances, and it is possible to add another

shunt R (see Fig. 17) without altering the nature of the oscillations.

Figs. 16 and 17 are merely theoretical diagrams, the practical application of the principle shown thereby to a wireless-telegraph receiving system being illustrated in Figs. 18 and 19.

As shown in Fig. 18, the shunt may be used for receiving the coherer or its equivalent. The closed circuit may be used for inducing currents in the secondary circuit, which contains the coherer, as shown by Fig. 19. Conditions will determine whether it is preferable to use a closed or open resonator.

I claim—

1. In wireless telegraphy, the combination with a closed oscillation-circuit, of an added piece of wire for restoring the symmetry disturbed by the sending or receiving wire, substantially as described.

2. In wireless telegraphy, the combination with a closed oscillation-circuit, of an added piece of wire in the form of a coil for restoring the symmetry disturbed by the sending or receiving wire, substantially as described.

3. In wireless telegraphy, the combination with a closed oscillation-circuit, of an added piece of wire and a condenser for restoring the symmetry disturbed by the sending or receiving wire, substantially as described.

4. In wireless telegraphy, the combination with a closed oscillation-circuit, of an added piece of wire in the form of a coil and a condenser for restoring the symmetry disturbed by the sending or receiving wire, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FERDINAND BRAUN.

Witnesses:

MARIA SCHORN,  
SIEGFRIED BRAUN.