

No. 621,561.

Patented Mar. 21, 1899.

W. P. FREEMAN.  
RESISTANCE COIL.

(Application filed June 8, 1898.)

(No Model.)

2 Sheets—Sheet 1.

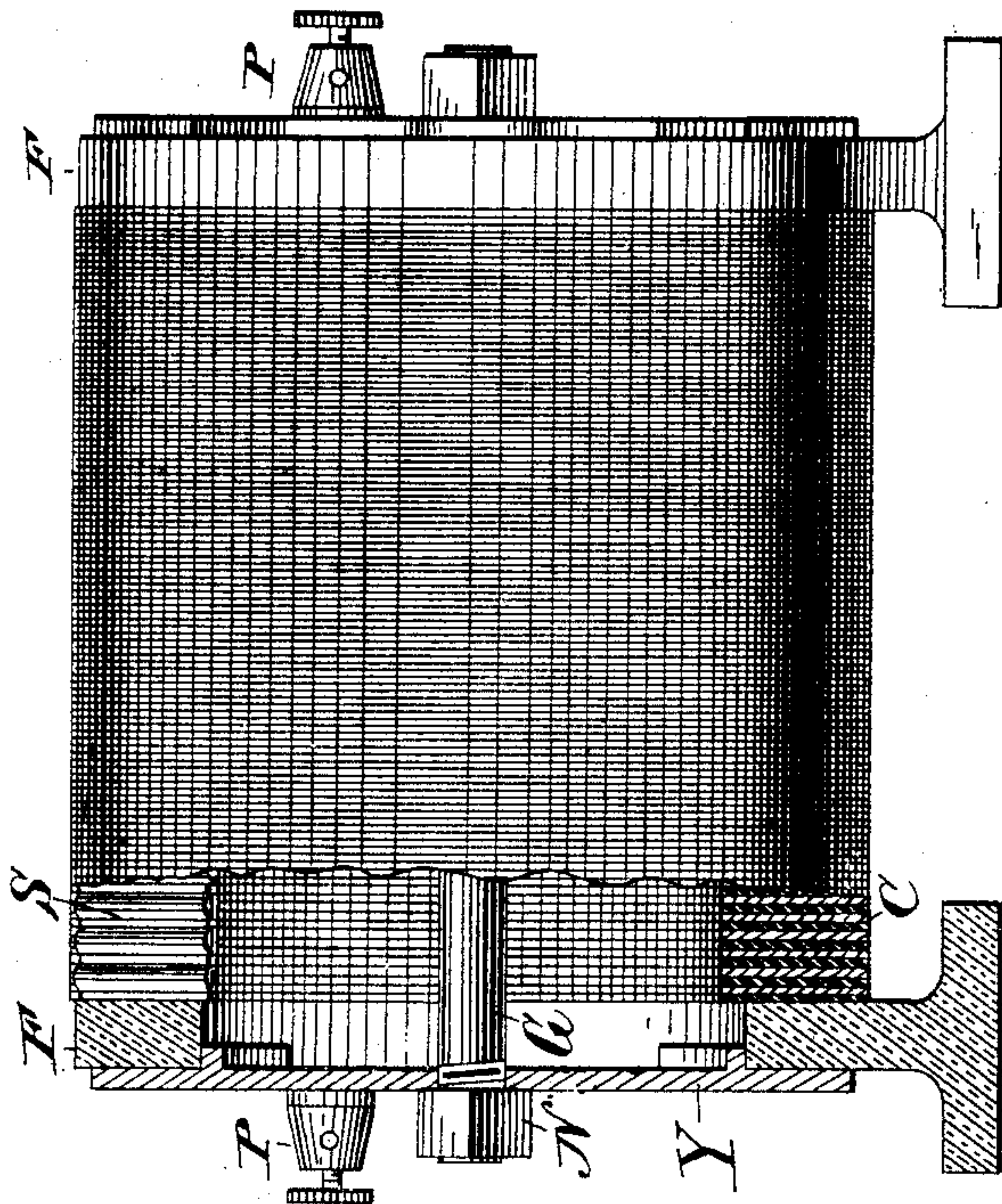


Fig. 2.

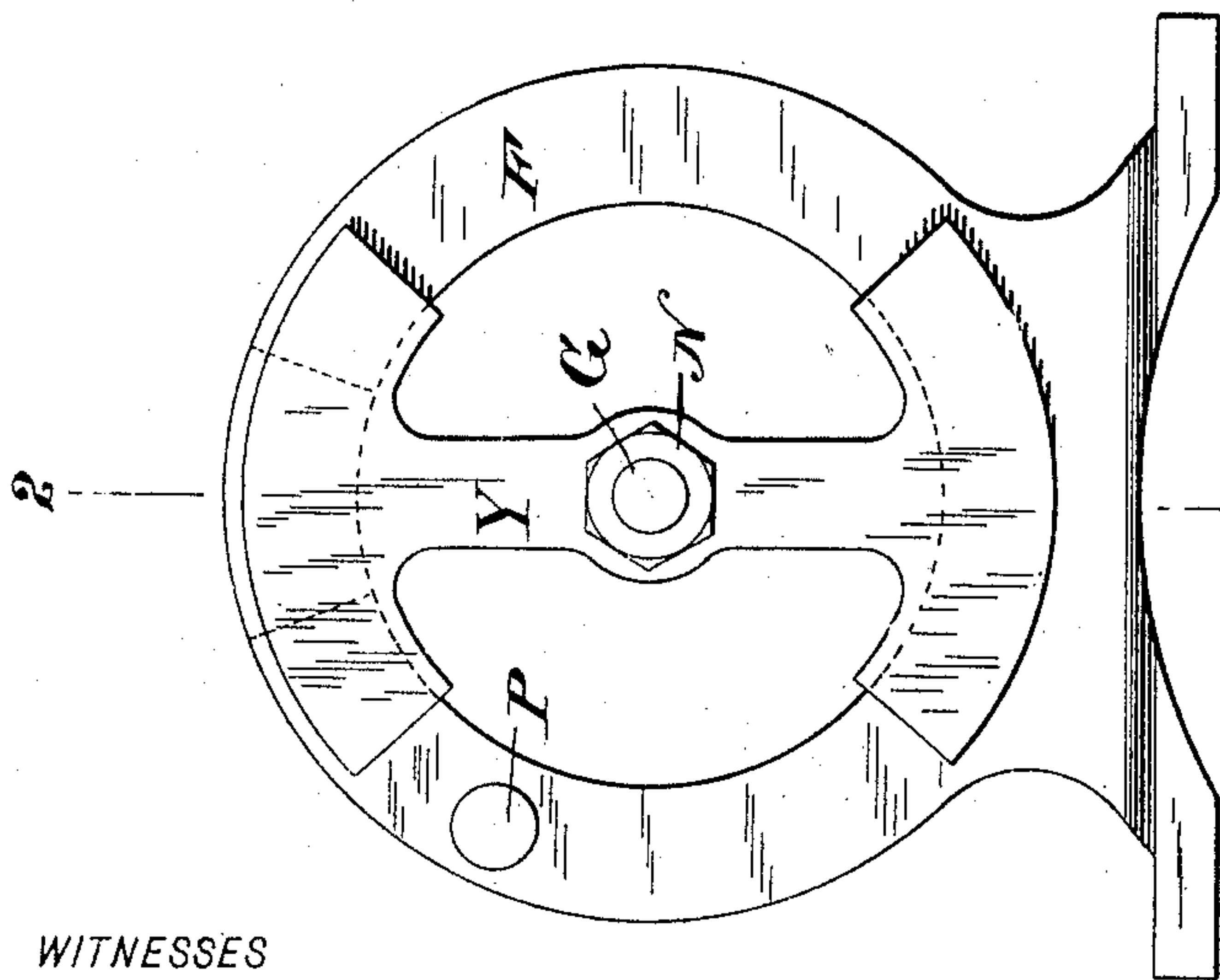


Fig. 1.

WITNESSES

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Fig. 5.

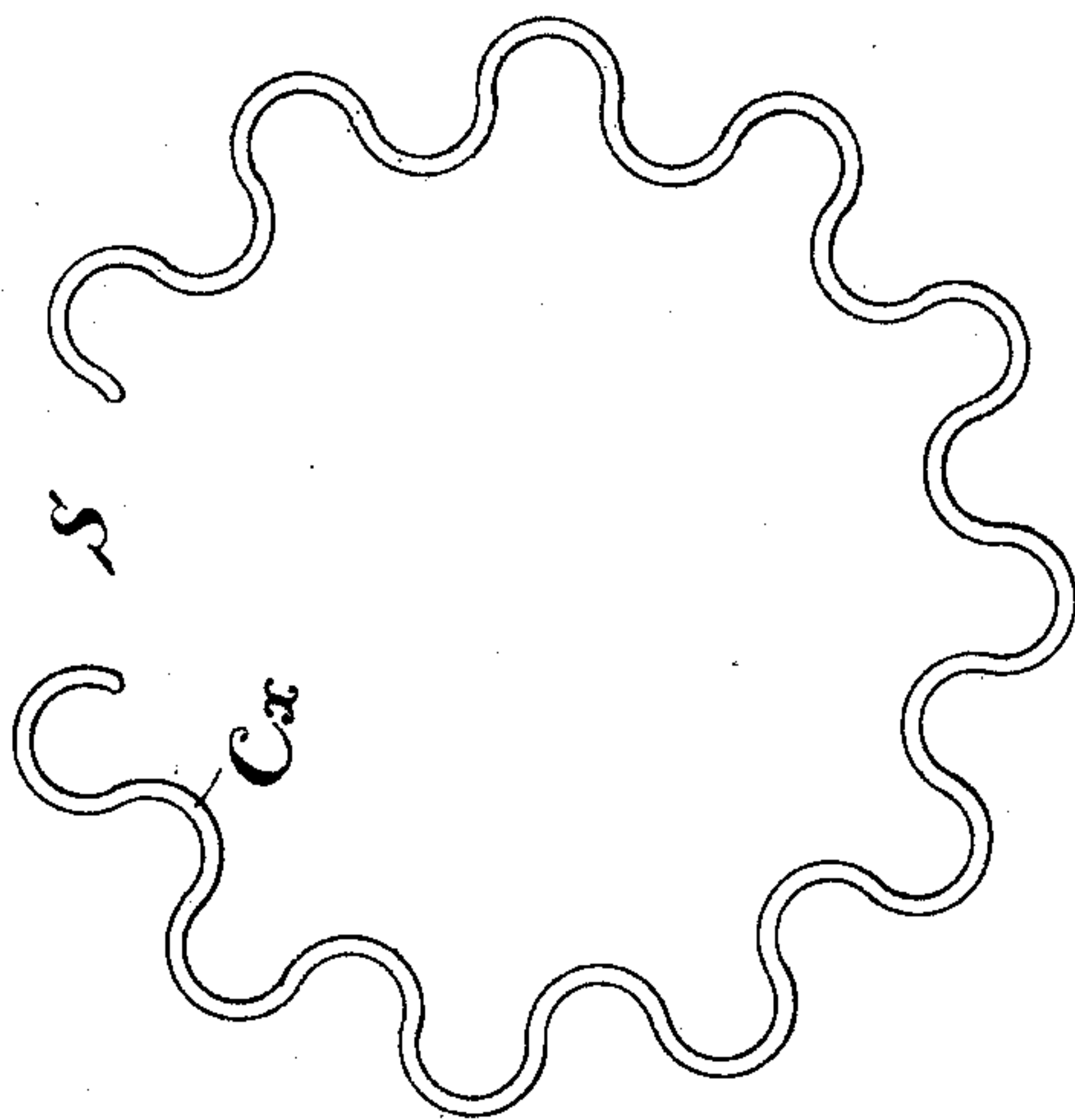


Fig. 3

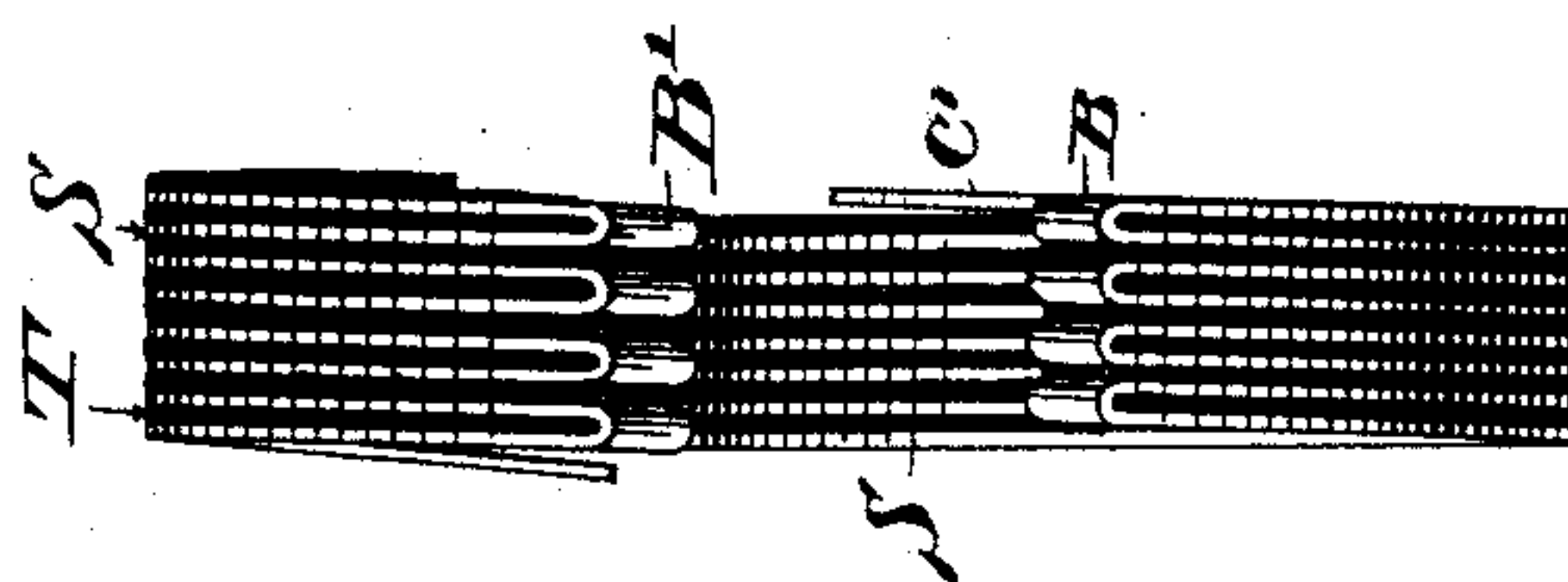
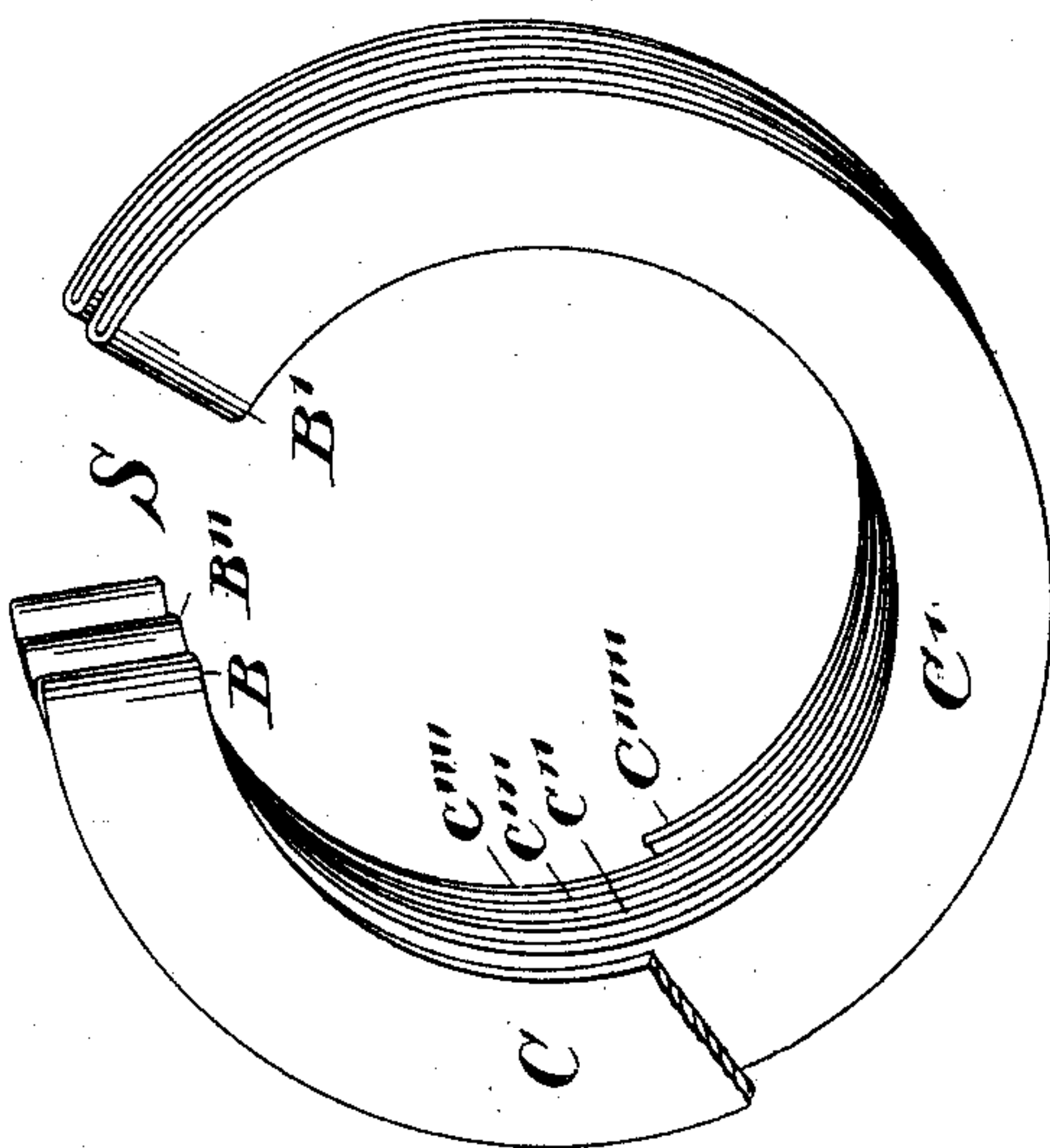


Fig. 4



WITNESSES

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# UNITED STATES PATENT OFFICE.

WARREN P. FREEMAN, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE EMPIRE ELECTRICAL MACHINERY COMPANY, OF NEW JERSEY.

## RESISTANCE-COIL.

SPECIFICATION forming part of Letters Patent No. 621,561, dated March 21, 1899.

Application filed June 8, 1898. Serial No. 682,961. (No model.)

*To all whom it may concern:*

Be it known that I, WARREN P. FREEMAN, of New York city, New York, have invented certain new and useful Improvements in Resistance-Coils, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

The nature of the invention will be readily understood from a description of the accompanying drawings, in which—

Figure 1 is an end view of the resistance-coil; Fig. 2, a side view, partly broken away, in section on the plane 2 2 of Fig. 1. Fig. 3 is a plan view of a portion of the coil. Fig. 4 is a perspective view showing a portion of the coil with the insulating material removed, and Fig. 5 shows a modified form of coil member.

Throughout the drawings like letters of reference indicate like or similar parts.

The main object of the invention is to simplify and perfect the construction of a resistance-coil which is applicable both to alternating and to constant currents, and particularly for heating purposes to provide for quick radiation and giving up of heat by the coil, and to make it neat in appearance and compact in construction.

I use the term "coil" in its broader sense, because it will be seen from this description and drawings that the term "coil" in the sense of a spiral or of a thing wound around several times in the same direction is inapplicable to the present construction.

In the forms shown in Figs. 1 to 4 the conducting portion of the coil consists of a number of layers, which for convenience I will term "convolutions," though no one of them makes a complete turn. Each convolution forms, in effect, an interrupted flat annulus or ring, the interruption of the several annuli or rings forming continuous opening S, Fig. 4, throughout the length of the coil. Between the several layers or interrupted rings are placed insulating and separating pieces T, and the connections between the successive interrupted rings are made alternately, as clearly seen in Fig. 4, whereby the left-hand end of the first ring joins the left-hand

end of the second ring, as at B, Fig. 4, while the right-hand end of the second ring joins the right-hand end of the third ring, as at B', and then in turn the left-hand end of the third ring joins the left-hand end of the fourth ring, and so on, forming a continuous winding conductor in the shape of a hollow cylinder having an opening S on one side. The several layers or rings of the coil may be separately formed and joined together in the coil or the whole coil may be formed from a continuous spiral by bending it back and forth. When a sufficient length of my coil has been formed and insulated, it may be clamped between end plates or frames F by means of a bolt G, nuts N, and yokes Y or in any other desired manner, and terminal connections may be made by providing binding-posts P at each end in electrical contact with the end of the resistance-coil. When so confined and tightly clamped together, as shown in Figs. 1 and 2, the exterior and interior surfaces of the coil may be entirely exposed or may be protected by a very thin layer of insulating material. I prefer to leave these surfaces exposed, so as to afford cooling-surface.

While the form of the coil shown in Figs. 1 and 2 is that at present preferred by me for general use, it must be understood that in the broader aspect of my invention the cross-section of the conductor is immaterial where compactness is not desired.

In Fig. 5 I show a modification in which each interrupted ring or layer of the coil consists of a serpentine wire C. This form of conductor, it will be seen, gives an increased length of conductor and an increased cooling-surface as compared with the cross-section of metal.

Whatever form of conductor is used the ends of the successive layers or rings are alternately connected at the interval or opening S, as explained, and shown in Figs. 3 and 4. The current passing through such a resistance-coil traverses the successive layers or rings of the coil first in one direction and then in the other. In this way the self-induction is almost entirely eliminated.

My coil may be made of iron or of any desired conductor. The magnetized effect of



the current is practically neutralized by the alternate direction in which it flows through the coils.

I claim and desire to secure by these Letters Patent the following:

1. A resistance-coil forming an interrupted hollow cylinder without a separate internal support, substantially as set forth.
2. A resistance-coil forming an interrupted hollow cylinder, and consisting of interrupted rings of conducting material, alternately connected at their respective ends, substantially as set forth.
3. A resistance-coil consisting of interrupted flat rings of conducting material with interposed insulating material, said rings being connected alternately at their ends, substantially as set forth.
4. A resistance-coil consisting of a flattened conductor extending in cylindrical form first in one direction and then in the other, insulating material separating the successive layers of the conducting material, and a frame

or support in which the said conducting material and said insulating material are clamped, substantially as set forth.

5. As an improvement in resistance-coils, the coil of conducting material, insulating material separating the coil into successive layers, and means for clamping the said layers and insulating material together, substantially as set forth.

6. As an improvement in resistance-coils, the coil of conducting material, insulating material separating the coil into successive layers, and the means for clamping the said layers and insulating material together, the exterior surface of the said coil being bare, substantially as set forth.

In testimony whereof I have hereunto set my hand, at New York, this 31st day of March, 1898.

WARREN P. FREEMAN.

Witnesses:

WENDELL FRANCIS BECKEY,  
HAROLD BINNEY.