

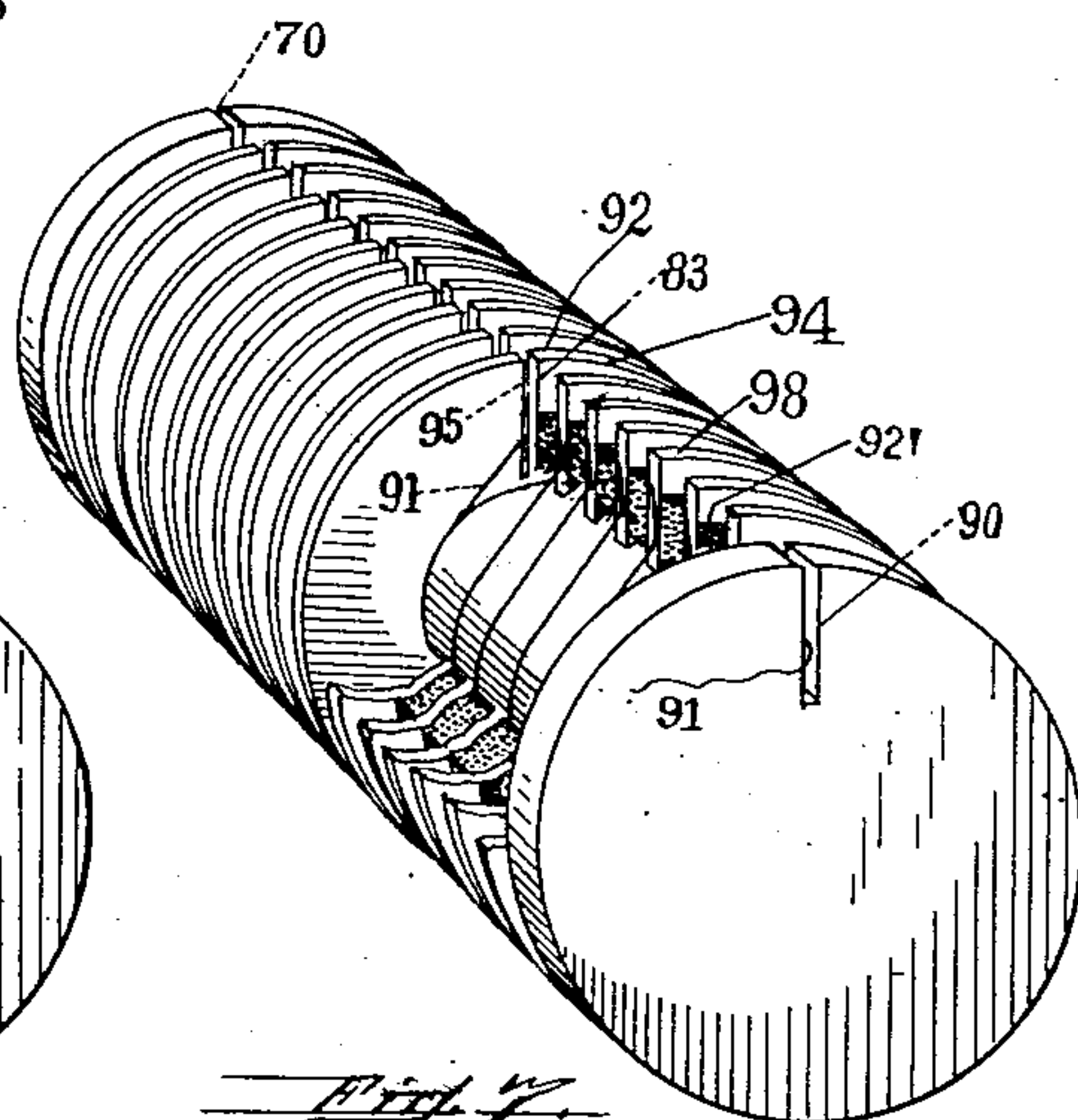
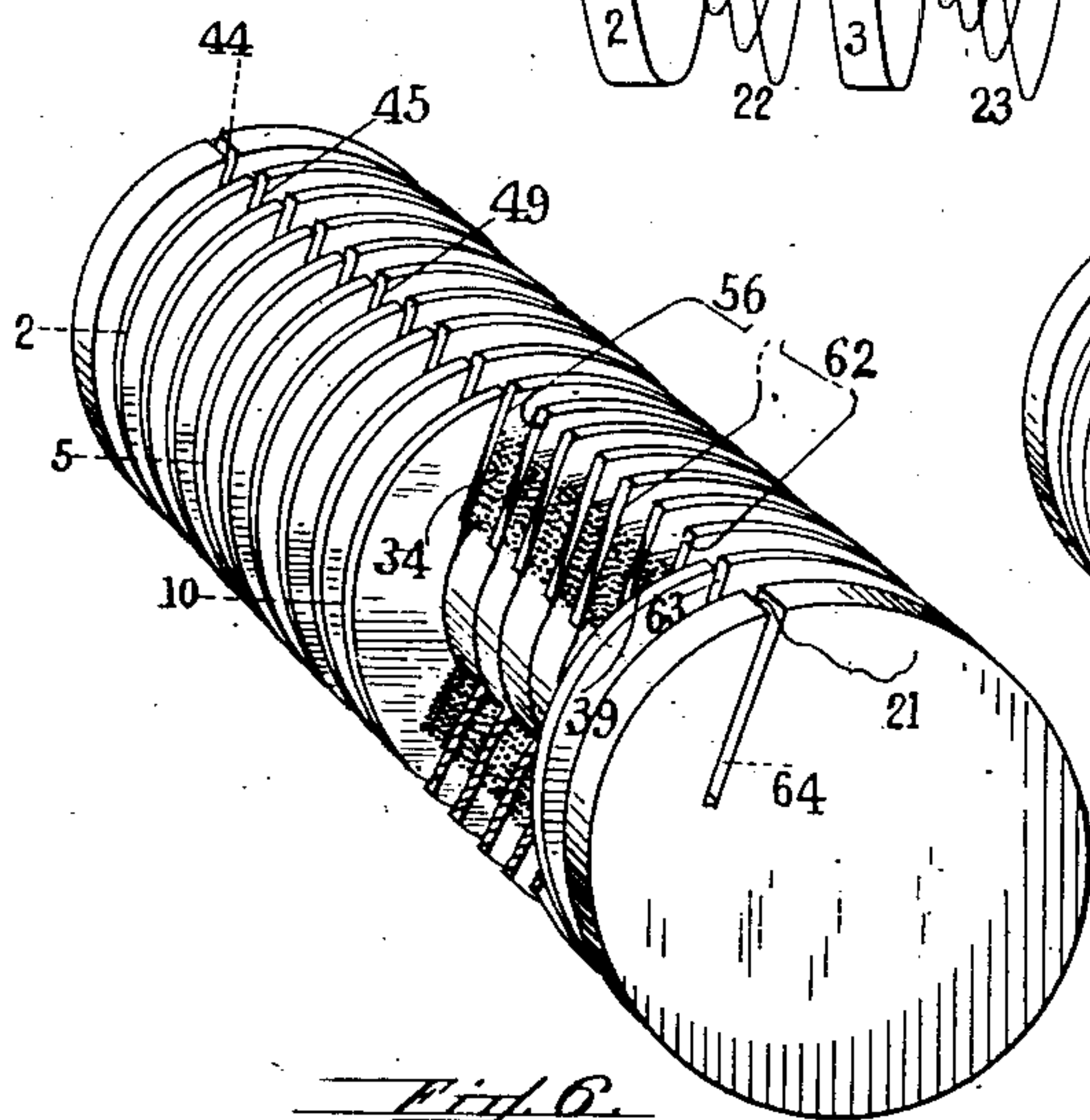
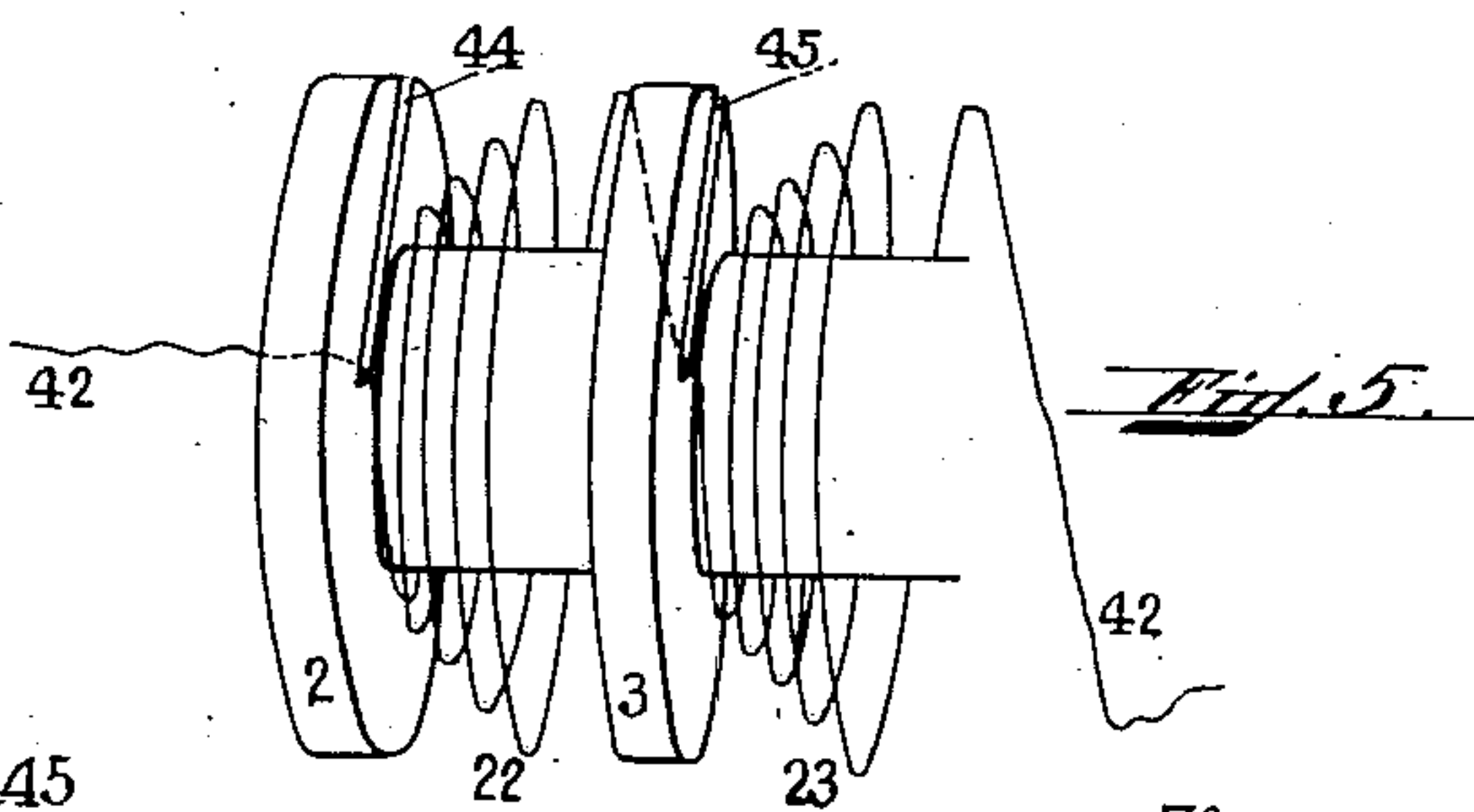
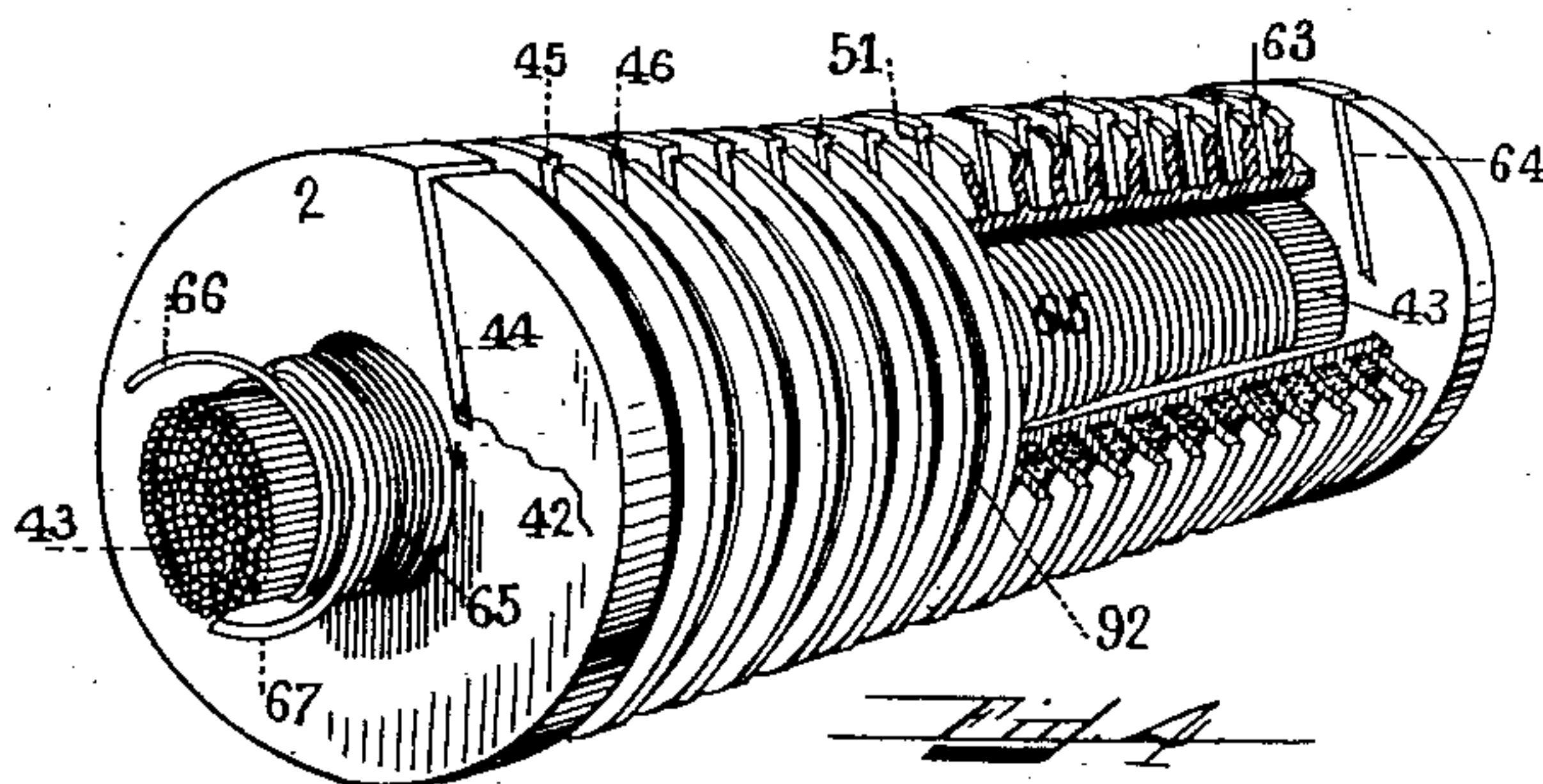
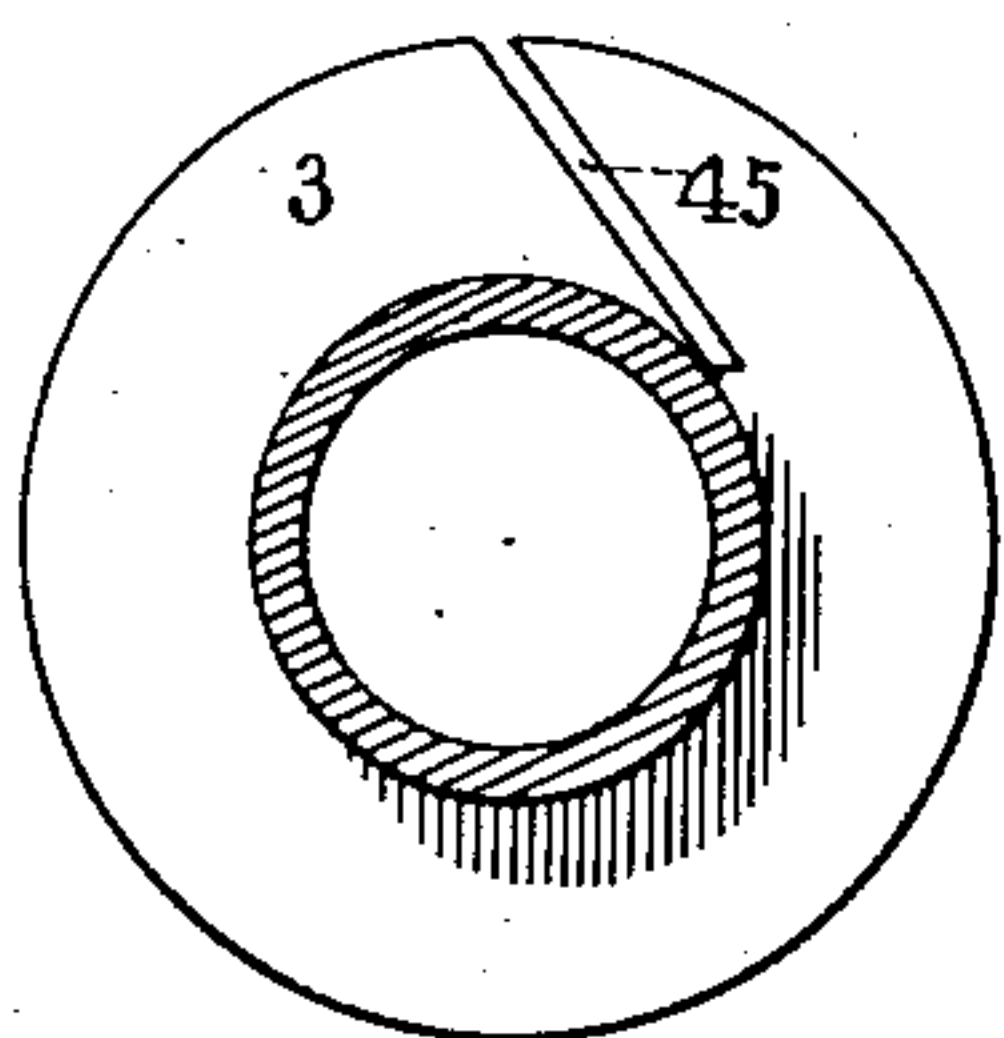
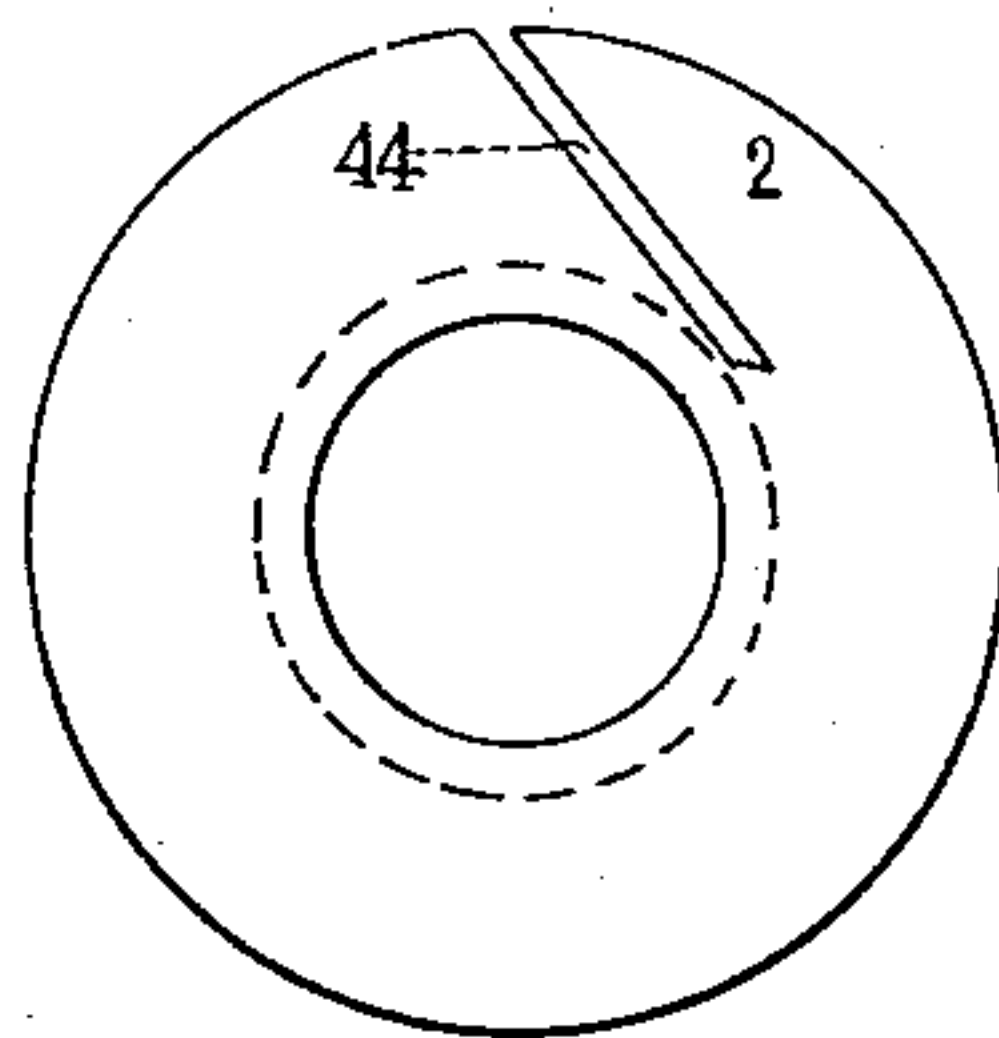
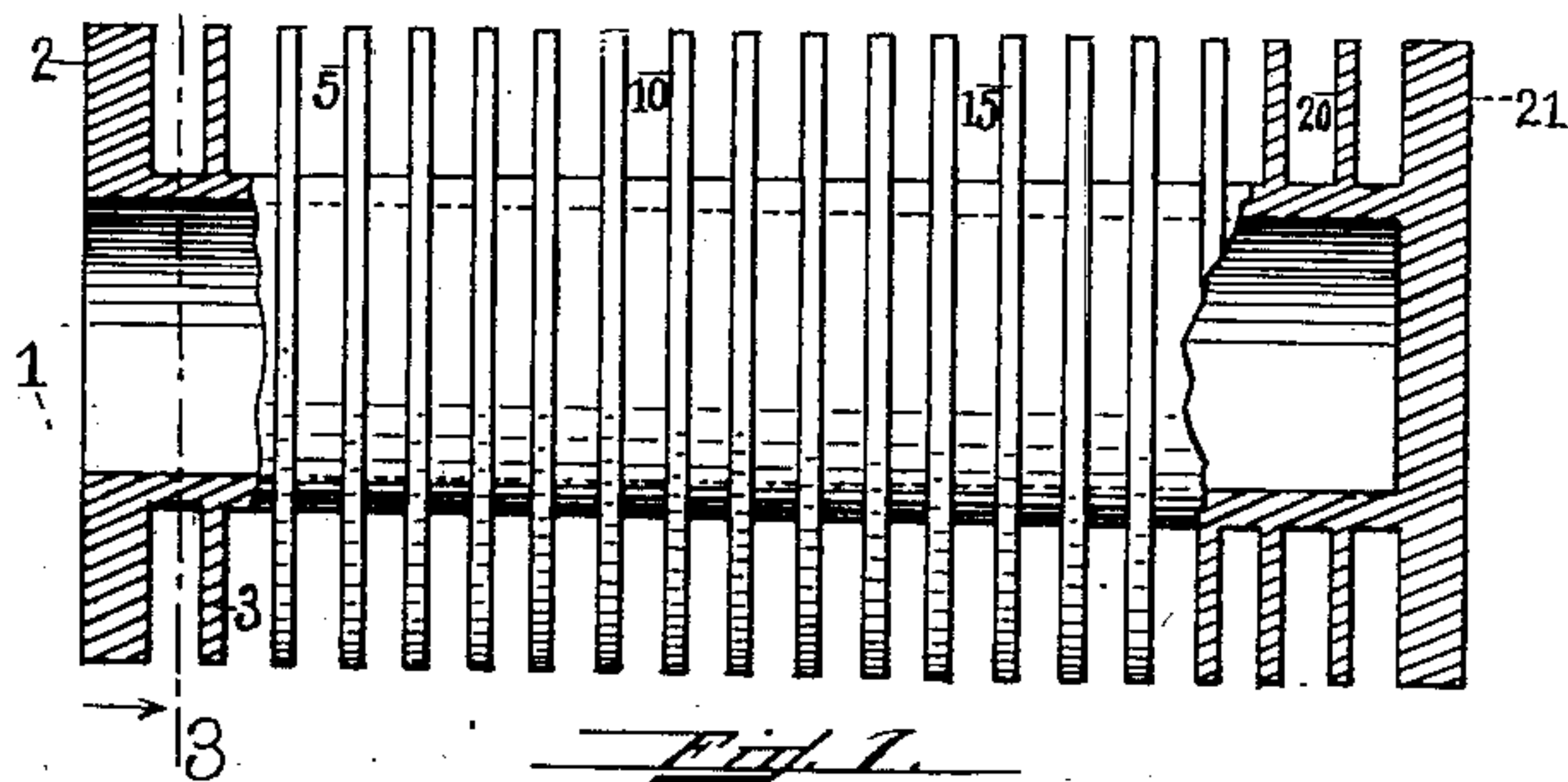
No. 863,175.

PATENTED AUG. 13, 1907.

J. O. HEINZE, JR.

INDUCTION COIL.

APPLICATION FILED MAR. 18, 1907.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

JOHN OTTO HEINZE, JR., OF LOWELL, MASSACHUSETTS.

## INDUCTION-COIL.

No. 863,175.

Specification of Letters Patent.

Patented Aug. 13, 1907.

Application filed March 18, 1907. Serial No. 362,856.

*To all whom it may concern:*

Be it known that I, JOHN OTTO HEINZE, JR., a citizen of the United States, residing at Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Induction-Coils, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to induction coils, and resides in an improved coil bobbin and winding, especially adapted to high voltage induced currents.

Previous coils have been made usually in either one of two ways; first, by having a central insulating tube over the length of which is wound wire, layer upon layer; adjacent layers being separated by a layer of insulating paper; or second, by building upon an insulating tube, a series of pan-cake coils which are separated from each other by insulating disks, and which, in the process of building up, alternately have the two inner ends of adjacent pan-cake coils connected together, as by soldering, and then the two outer ends likewise connected. This process of building up is continued until the desired number of pan-cake coils have been provided and connected.

The principal difference between the first coil and second coil is that in the former, the highest potential exists between the outer layer of wire and the inner layer of wire, in which case if the coil has a length greater than the distance between the inner layer and the outer layer, the actual sparking length of the coil would be greater than this distance; while in the latter or second coil, the greatest voltage exists between the pan-cake coil on one end of the spool, and the pan-cake coil upon the other end of the spool; and if the dimensions of the second coil, as to diameter and length of coil, and length of spark, are the same as in the first coil, then the relative distance between the two ends of the coil may be, say, four or five times the spark length, while in the first coil the distance between the two ends would be less than the spark length. In fine, in the first coil, its sparking distance is limited by the distance between its inner and outer layer; while in the second, the sparking distance is always less than the distance between the ends of the coil; but in the manufacture of these coils, the cost of winding the former, is much less than that of assembling and connecting the pan-cake coils of the latter; while the efficiency of the latter is much greater than the former.

Now, therefore, the principal object of my invention is so to design a spool, first, that one continuous insulated wire can be wound thereon to form pan-cake coils, and thus to do away with making separate pan-cake connections; and second, that that portion of the insulated wire leading from one pan-cake coil to the next pan-cake coil, will not contact any two layers of wire in either pan-cake coil.

The above object is attained by means of an insulat-

ing spool having insulating pan-cake forming partitions provided with slots tangential to the surface of the spool, so that the insulated wire leading from the top of one pan-cake coil, into position to begin being spun to form the bottom of the next coil, lies within the slot and can not cross and contact any two layers of wire in either coil.

A slot not tangential, but, say, radial to the spool surface, may be used, but the object of my invention is then only imperfectly attained; all of which will become plain hereinafter.

In the drawings, I have shown the best mode now known to me of embodying the principle of my invention.

Figure 1 is a side elevation of improved spool, the end portions of its sides being broken away in section to show that one end is closed, and the other is open. Fig. 2 is an end elevation of the spool showing a tangential winding slot. Fig. 3 is a section of Fig. 1 on line 3—3. Fig. 4 shows in perspective said spool with pan-cake windings thereon, and a core with a primary winding therein; a portion of said spool and the secondary winding broken away for the purpose of showing the disposition of the core and primary winding within the spool. Fig. 5 is a diagrammatic perspective view showing how the secondary wire leads diagonally through a winding slot in one pan-cake partition, begins to be wound on the surface of the spool, and after it forms a pan-cake coil, is led from the top of said pan-cake coil through a winding slot in the next partition, to the surface of the spool, where the next pan-cake is formed; and so on. Fig. 6 is a perspective view, a portion of the pan-cake coil partitions being removed to illustrate how the wire is led from the top of one pan-cake coil, through the partition slot, to form the bottom of the next succeeding pan-cake coil. Fig. 7 shows a modified form of my invention in which the slot instead of being tangential to the surface of the spool, is at right angles thereto; a portion of the pan-cake partitions being broken away to point out how the wire in being led from the top of one pan-cake coil through the said partition to form the next pan-cake coil, does not emerge from said slot at its bottom at the said spool surface, but at a distance above said point.

My improved spool is made of an insulating compound, such as hard rubber molded into form by any well known method. It has partitions 2, 21, between which, pan-cake coils 22, 23, Fig. 5, are to be wound upon the spool surface, from one continuous piece of wire 42. One end of said spool is open, for the reception of the core 43; while the other end is preferably closed. Slots 44, 54, are cut in these pan-cake partitions, 2, 21, Figs. 2 and 6, and are preferably tangential to the surface of the spool.

The core 13 consists of a bundle of fine metallic



wires, secured together by a primary winding of wire 65, so wound that the ends 66, 67, of said winding protrude from the open end of the spool.

The wire 42, Figs. 2, 4, 5, to form the first pan-cake coil 22, is introduced through the slot 44, as in the outer pan-cake partition 2, and by revolving the spool, by any suitable means, the wire 22 is wound between the partitions 2, 3, until the first pan-cake coil is formed; the spool is then stopped, and the wire drawn into the slot 45 in the next partition 3, carried to the bottom thereof and into the next coil space. The spool is again set in motion, another pan-cake coil 23 is made, and the wire is once more drawn into the top portion of the slot 46, in the next partition 4, diagonally through the same and out at the bottom thereof on to the next spool surface, to be spun into still another pan-cake coil, as 24. This operation is repeated until the desired number of pan-cake coils is completed.

Fig. 6 shows the actual succeeding positions of the wire, assumed in its course from the top of pan-cake coils 34, 39, through the slots 56, 62, until after it has begun to be wound about the surfaces of the spool, to form the next succeeding pan-cake coils, 35, 39. The wire from the last pan-cake coil is led out through the slot 64 in the outer partition 21 of the spool, and may be secured therein. In short, by means of my invention, a continuous insulated wire may be wound from the bottom of one pan-cake space until the pan-cake coil is formed, and then from the top of said pan-cake coil diagonally through a partition slot to the bottom of the next succeeding space to form the next pan-cake coil, without touching any portion of the two adjacent pan-cake coils. Further, it is very obvious that by means of this feature of my invention, the desirable pan-cake coils can be very speedily formed upon the spool, without the necessity of first forming the coils separately and then connecting their inner and their outer ends, as by solder.

A modified form of my invention is shown in Fig. 7, and, as already stated in a description of this figure, it shows the slots 70, 90, as being perpendicular to the surface of the spool. The drawing makes it plain that by reason of such position of the slot, as 83, the wire, as 91, when led taut from the top of one pan-cake coil, as 92, through the slot 83 in the partition, as 94, and about the spool surface, to form the bottom of the next pan-cake coil, tends to lie in one plane and rise along the edge 95 of the slot 83, about which it is bent to be wound about the surface of the spool. Of course, so much of the wire as lies against the partition after emerging from the slot, and not contacting the surface of the spool, will, when the entire pan-cake coil is wound, necessarily be in contact with two or more of the layers of wire forming the pan-cake coil, but the number of contacts made by said wire will depend upon the point at which it leaves the edge of the slot. The position of this point will of course vary with the

angle the slot makes with the radius of the curved spool surface.

Having now described my invention and the best mode now known to me of embodying the principle thereof, but well knowing that all persons skilled in the art to which this invention appertains can, once understanding said principle, embody said invention in many different forms without departing from the spirit thereof, I desire to protect my invention in the broadest manner legally possible.

What I claim is:—

1. A spool of insulating material having insulating partitions thereon, each of said partitions being provided with a slot whereby pan-cake coils can be wound upon said spool from one continuous piece of insulated wire, said wire being led from one pan-cake coil to the next pan-cake coil through said slot, for the purpose of avoiding touching layers of wire of each adjacent pan-cake coil.
2. A spool of insulating material, having insulating partitions integral therewith; each of said partitions being provided with a slot whereby pan-cake coils can be wound upon said spool from one continuous piece of insulated wire, said wire being led from one pan-cake coil to the next pan-cake coil through said slot, for the purpose of avoiding contacts with layers of wire of a pan-cake coil.
3. A spool and individual partitions integral therewith, formed out of insulating material and having slots therein tangential with the surface of the spool; insulated pan-cake coils wound from continuous wire from the bottom of one pan-cake space to the top of said space, through said slot, to the bottom of the next pan-cake space to the top of said pan-cake coil space, and so on.
4. A spool of insulating material having insulating partitions therein, each of said partitions being provided with a slot, tangential to the surface of the spool, whereby pan-cake coils can be wound upon said spool from one continuous piece of insulated wire, said wire being led from one pan-cake coil to the next pan-cake coil through said slot, for the purpose of avoiding touching any two layers of wire of a pan-cake coil.
5. A spool and individual partitions integral therewith, formed out of insulating material and having wire slots therein tangential with the surface of the spool; insulated pan-cake coils wound from continuous wire from the bottom of one pan-cake space to the top of said space, through said slot, to the bottom of the next pan-cake space to the top of said pan-cake coil space, and so on; a longitudinal hole in said spool; and a core of magnetic material, and a primary wire mounted in said hole.
6. A spool and individual partitions integral therewith, formed out of insulating material and having wire slots therein tangential with the surface of the spool; insulated pan-cake coils wound from continuous wire from the bottom of one pan-cake space to the top of said space, through said slot, to the bottom of the next pan-cake space to the top of said pan-cake coil space, and so on; a longitudinal hole in said spool, closed at one end; a core of magnetic material and a primary wire all mounted in said hole, both ends of said primary wire protruding from said hole.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN OTTO HEINZE, JR.

Witnesses:

A. I. CRAWFORD.

E. F. UNIAC.