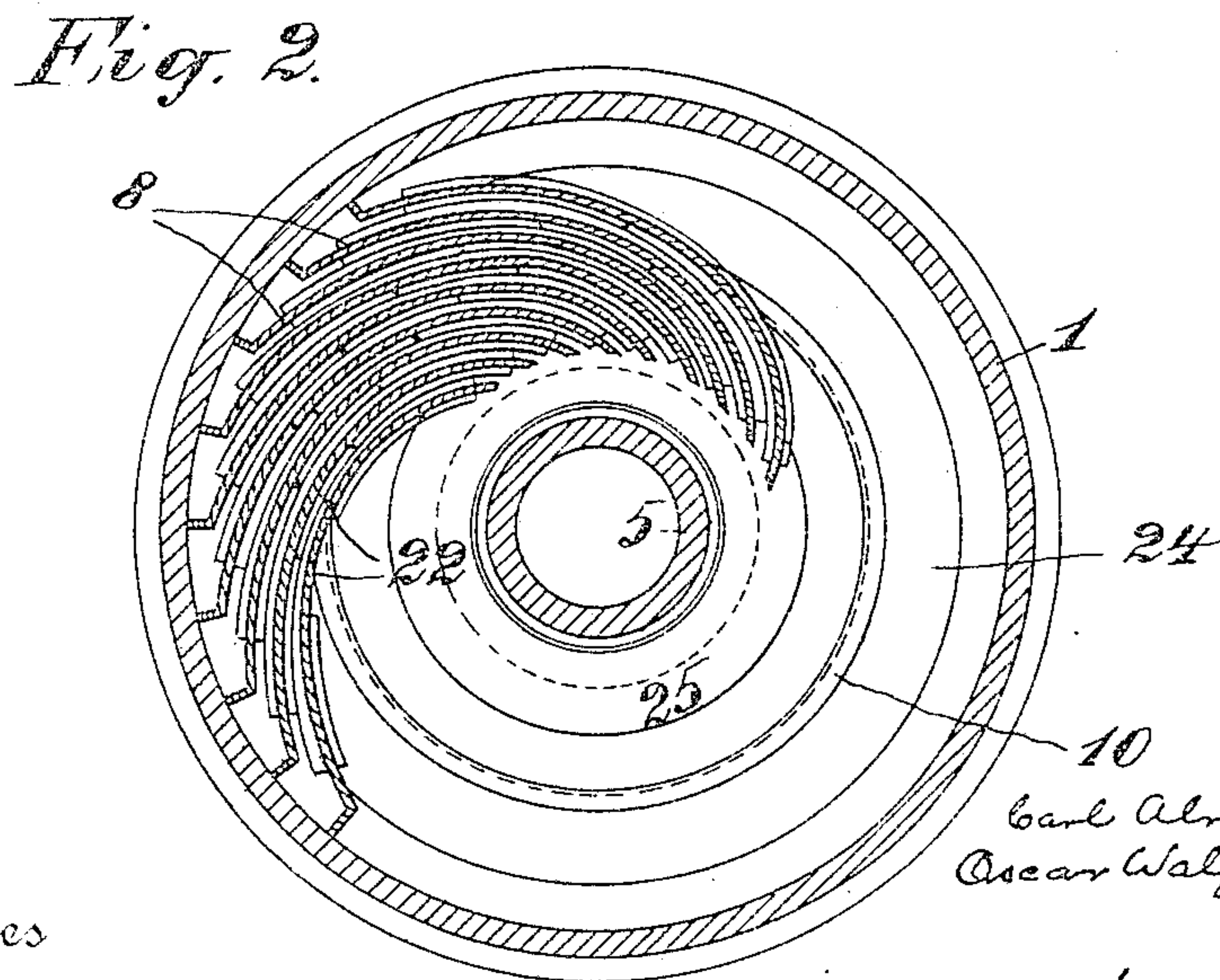
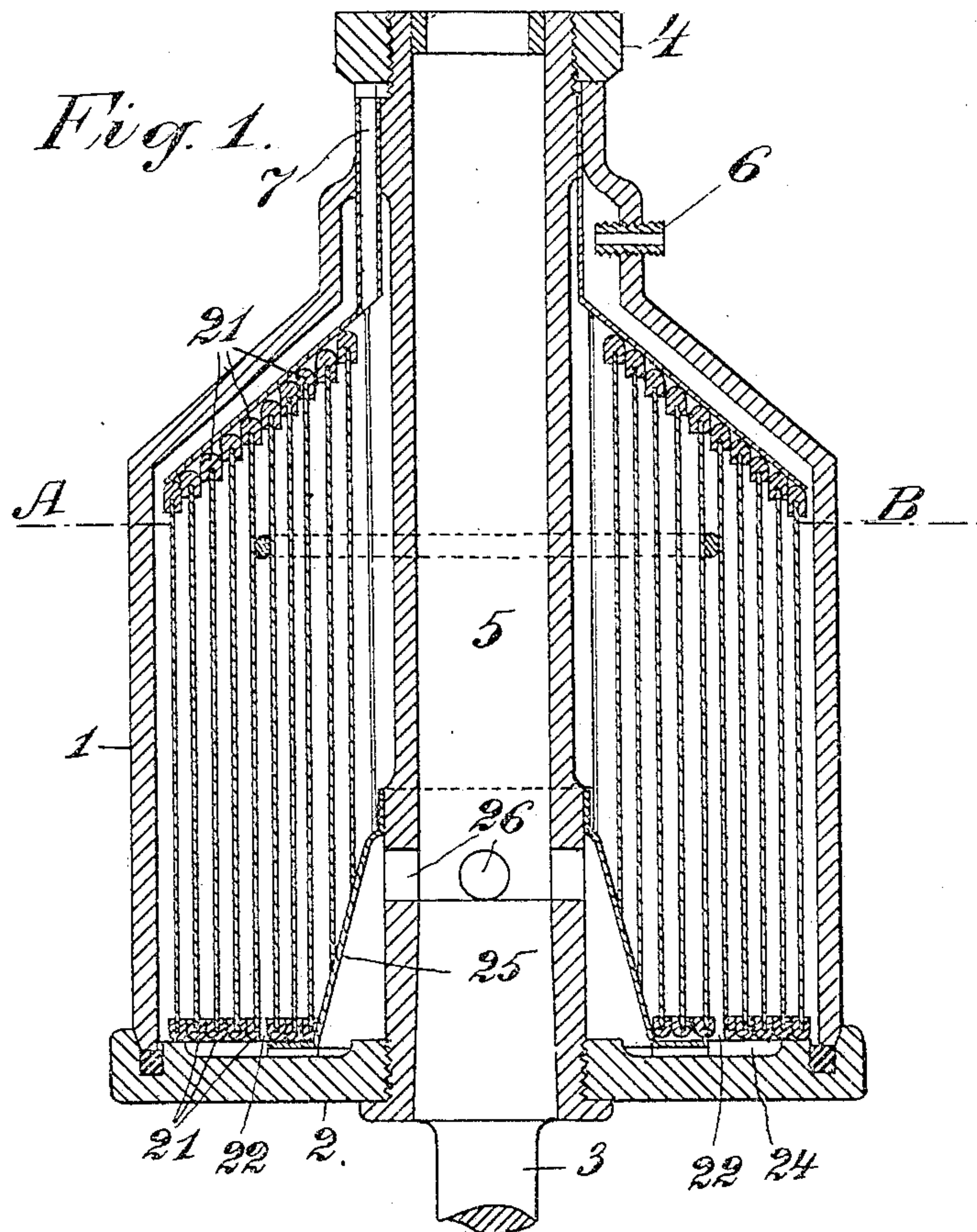


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LINER FOR CENTRIFUGAL SEPARATORS.

APPLICATION FILED FEB. 5, 1904.

5 SHEETS—SHEET 1.



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5 SHEETS—SHEET 2.

Fig. 3.

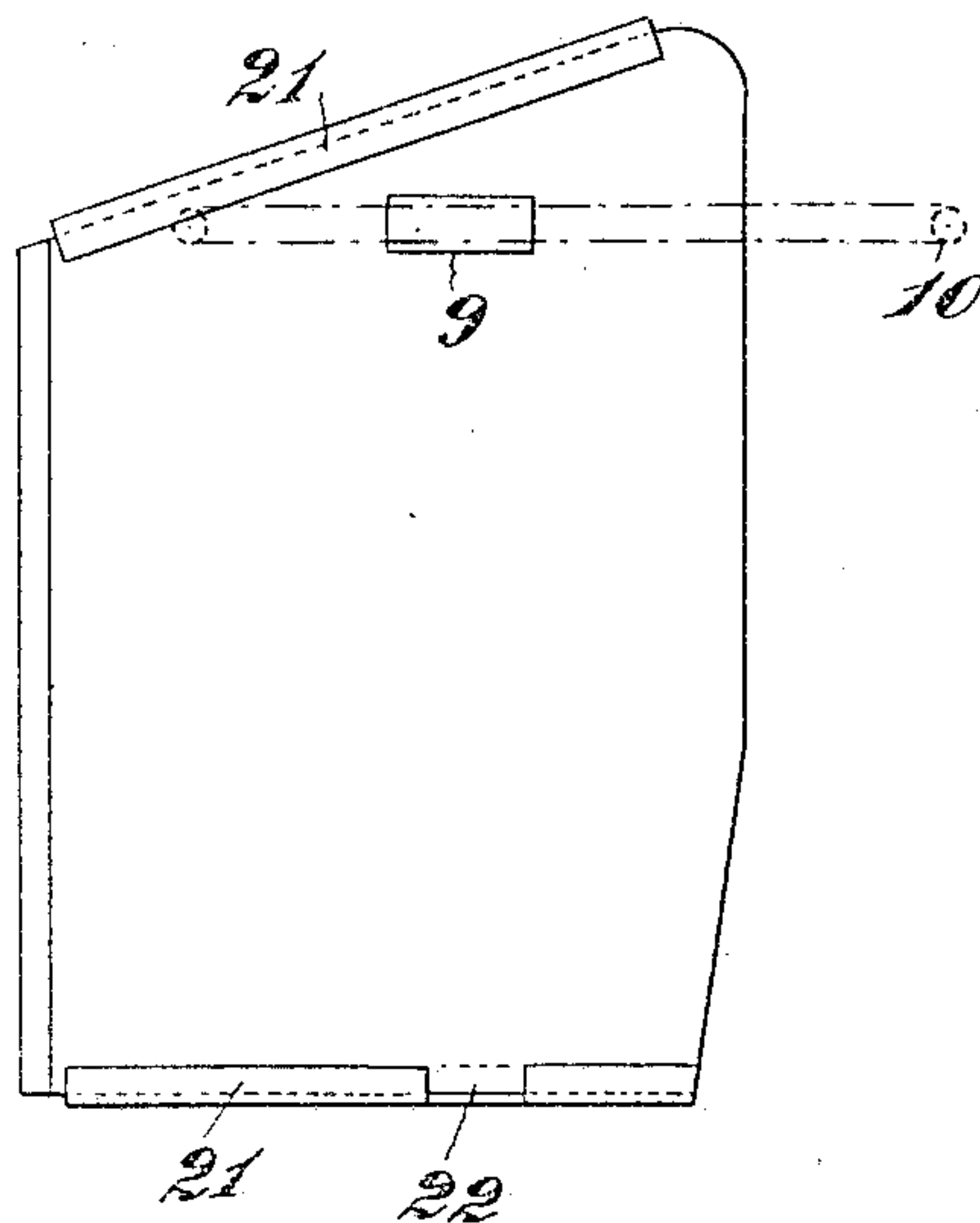


Fig. 4.

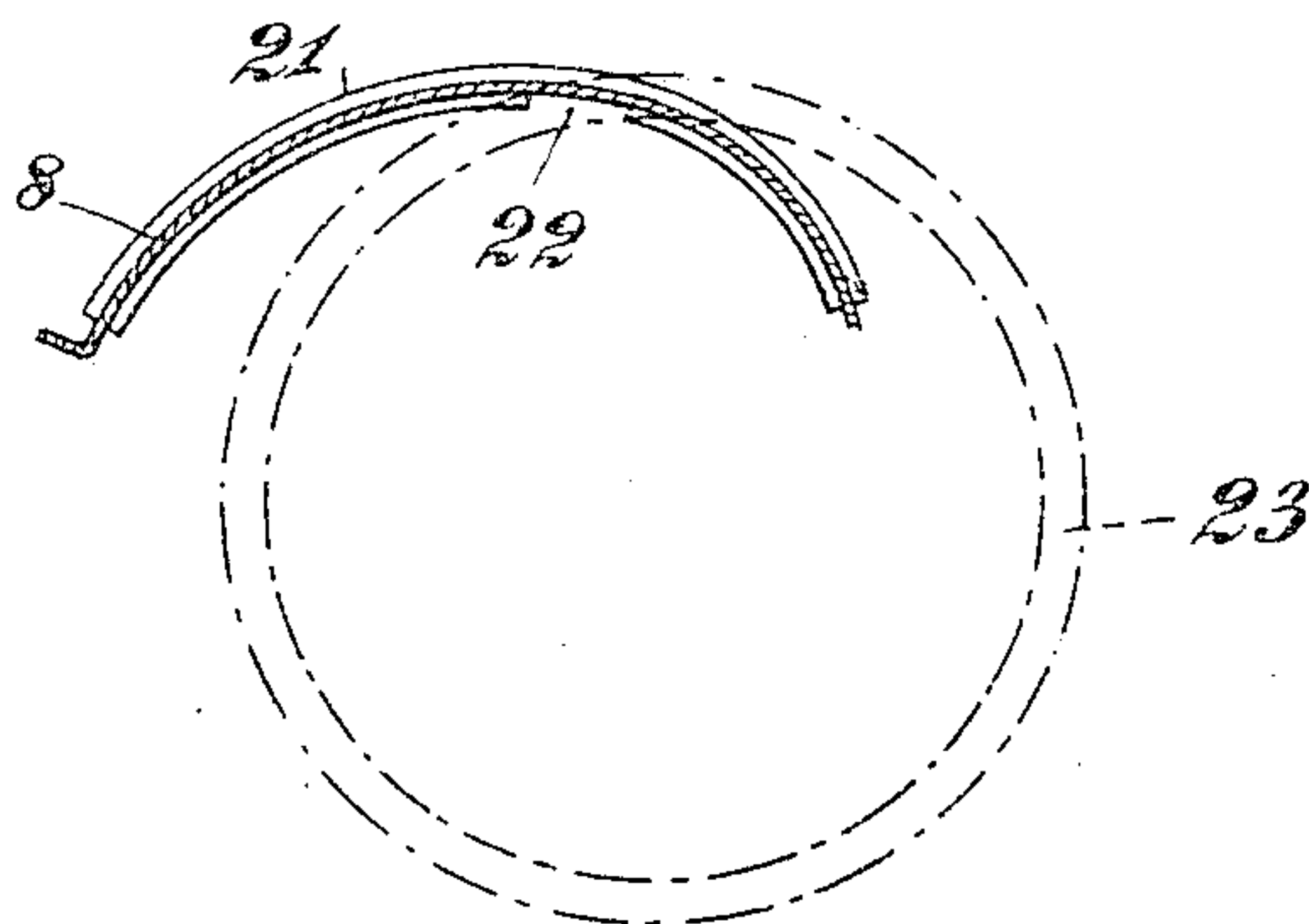
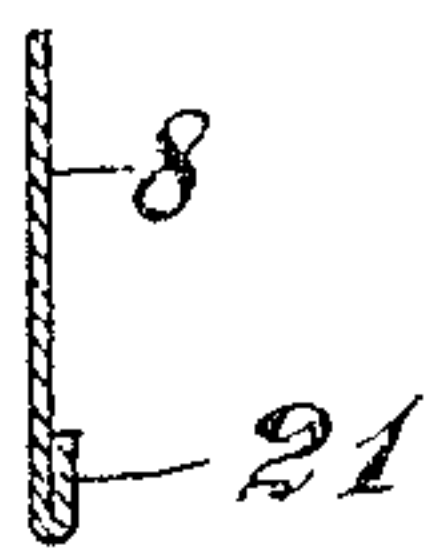
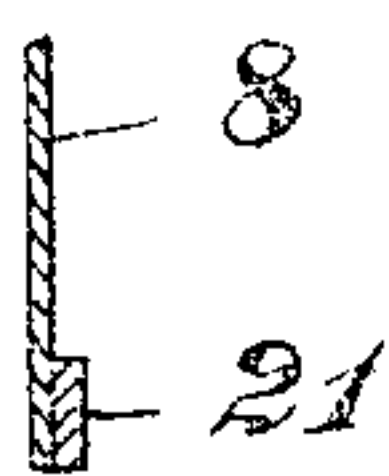


Fig. 3a *Fig. 3b*



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Fig. 5.

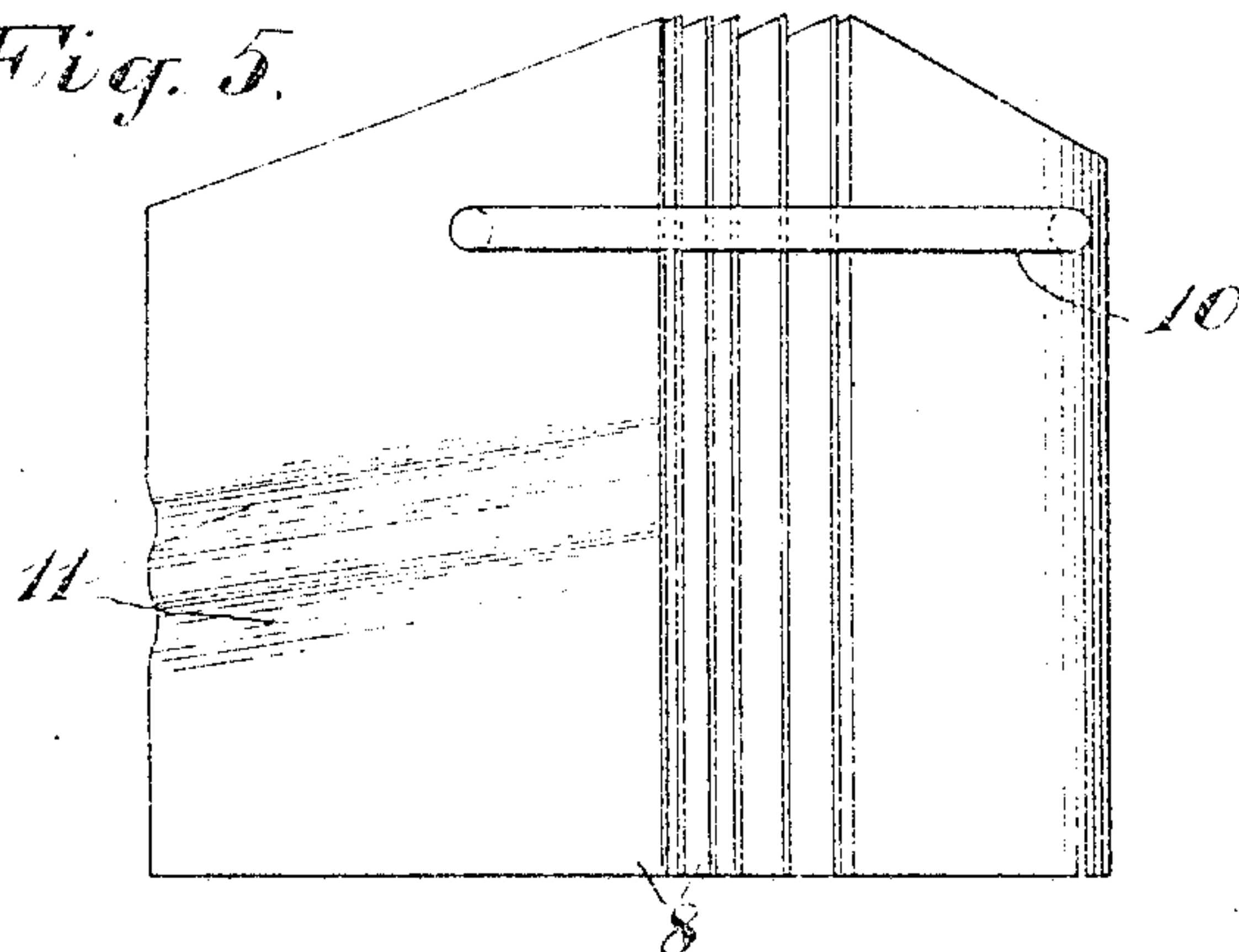


Fig. 6.

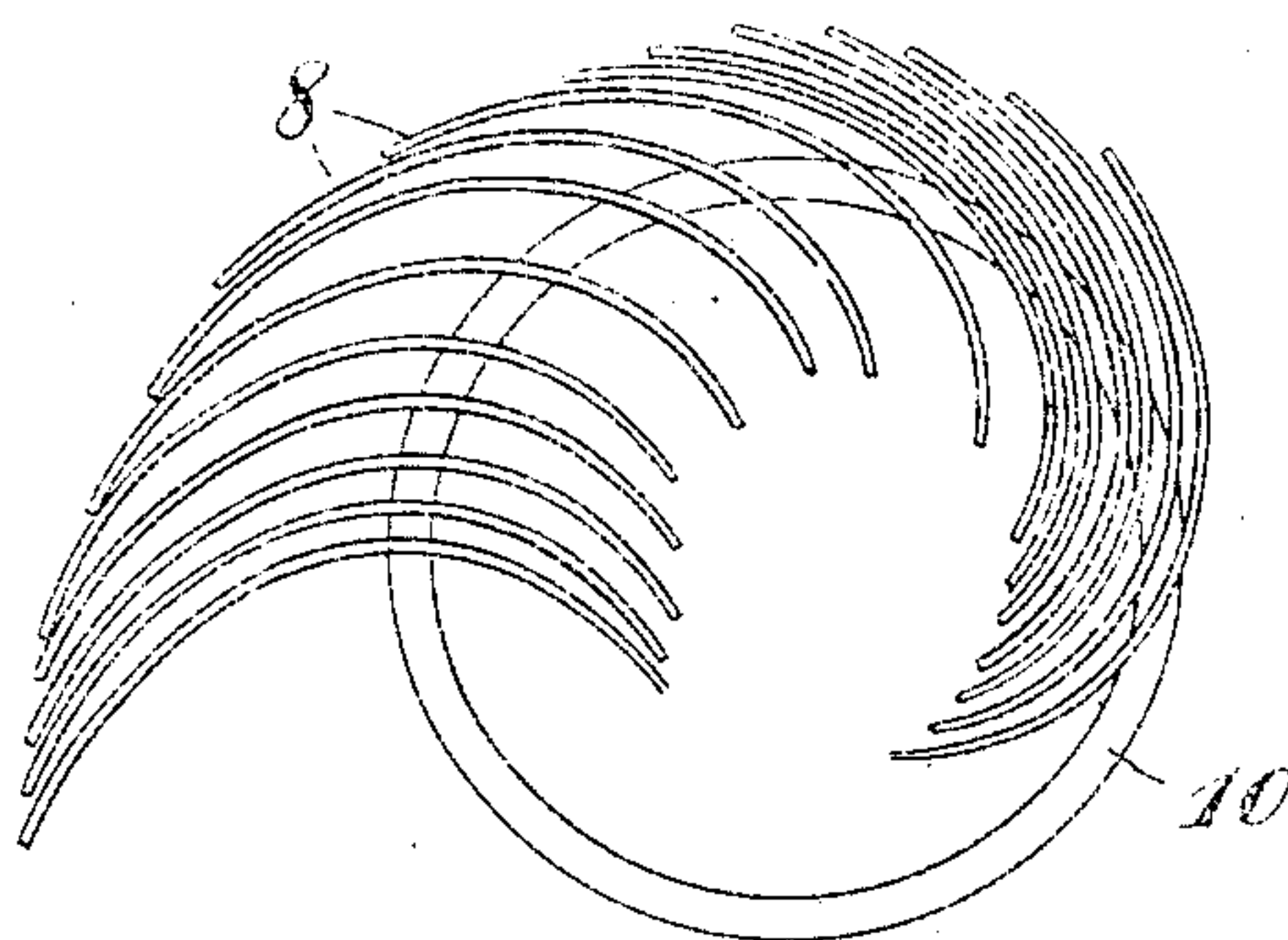
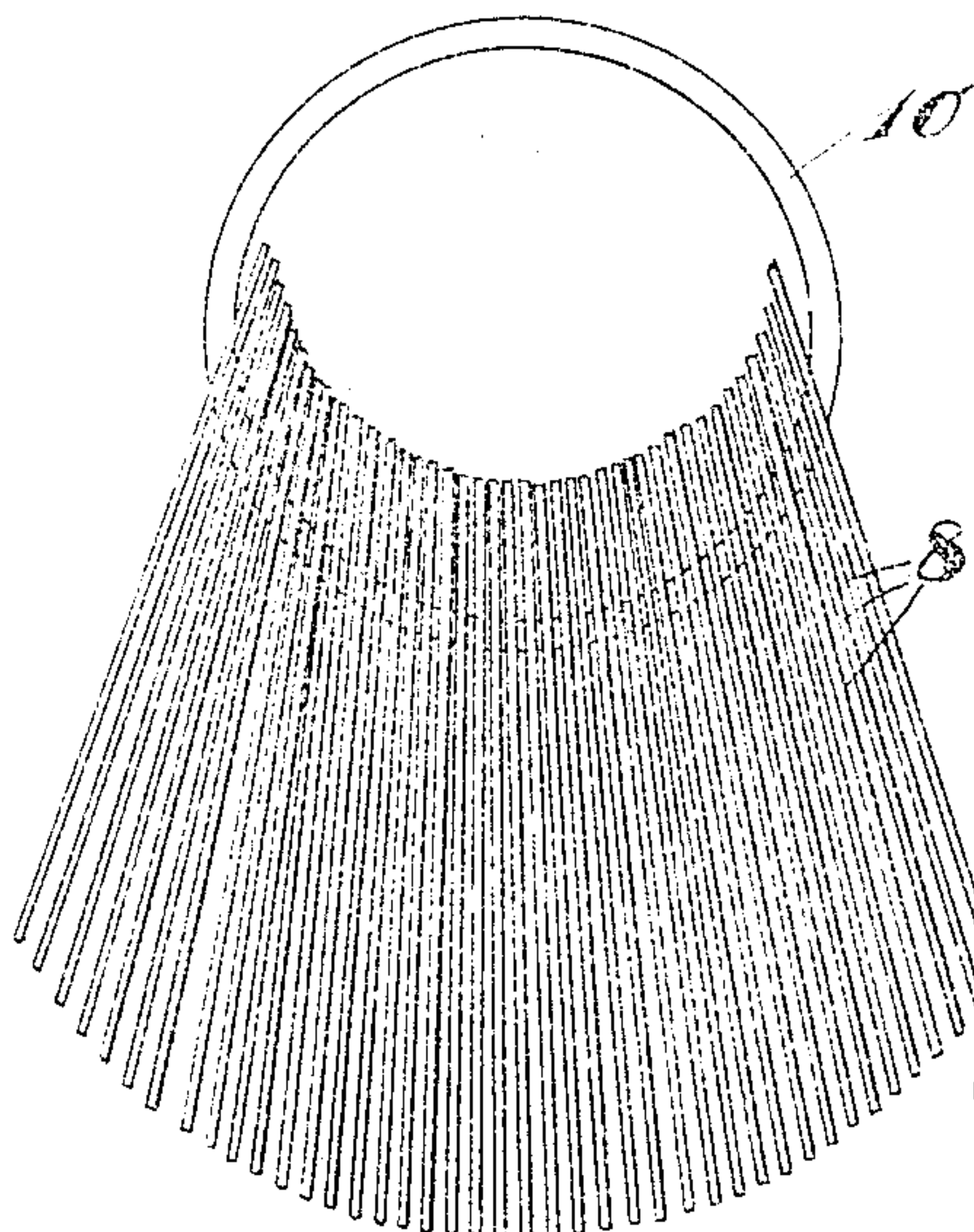


Fig. 7.



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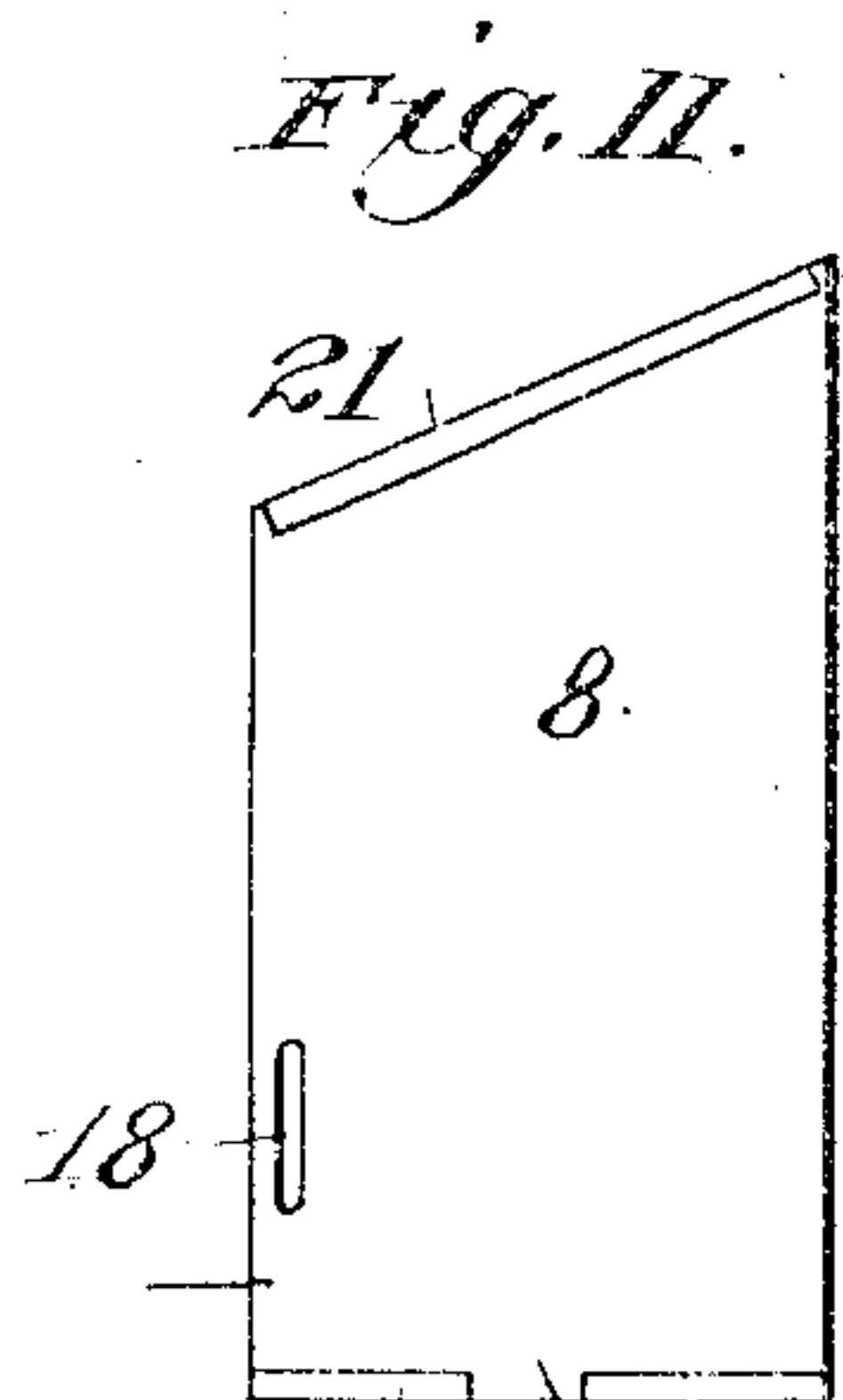
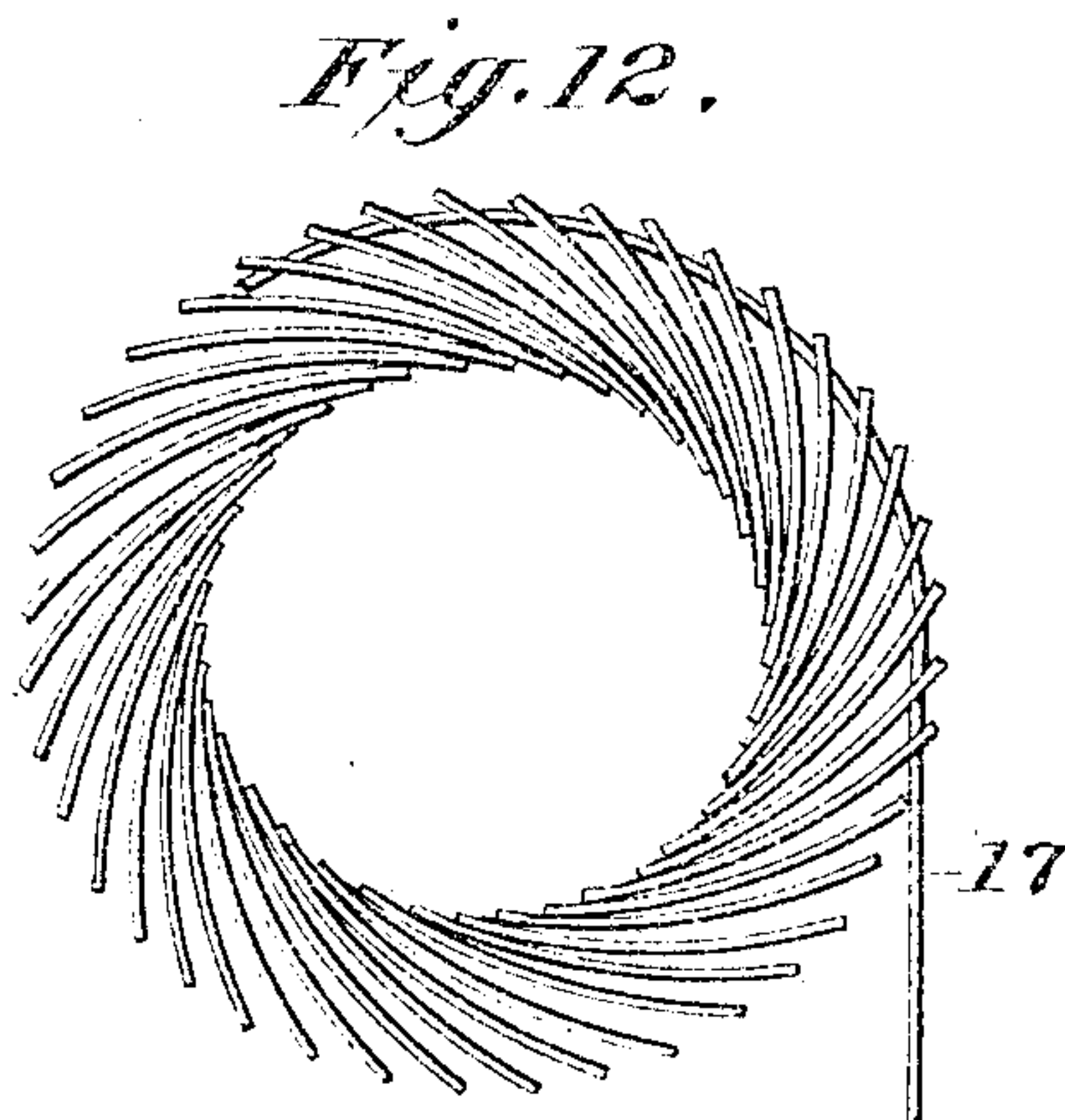
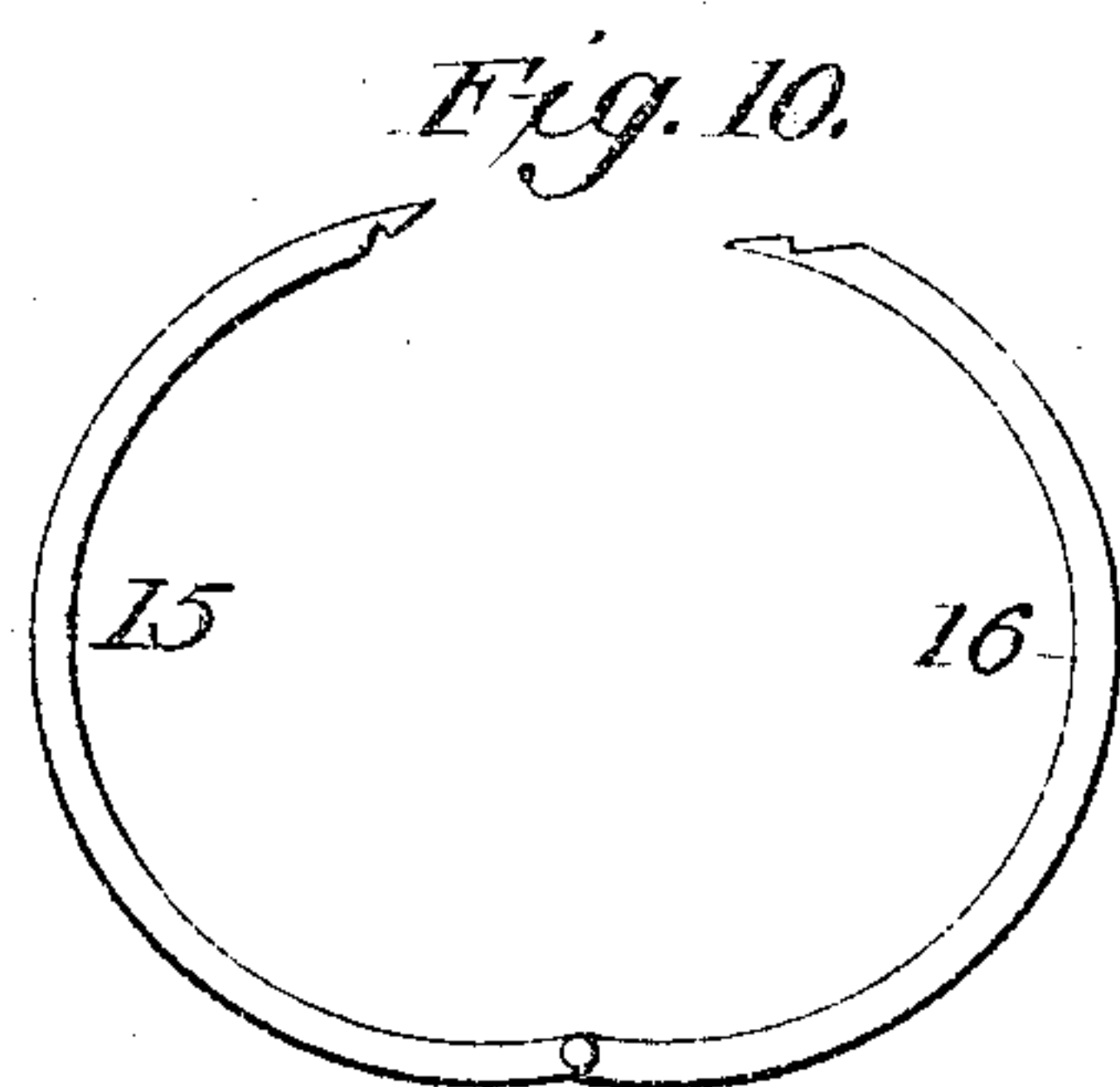
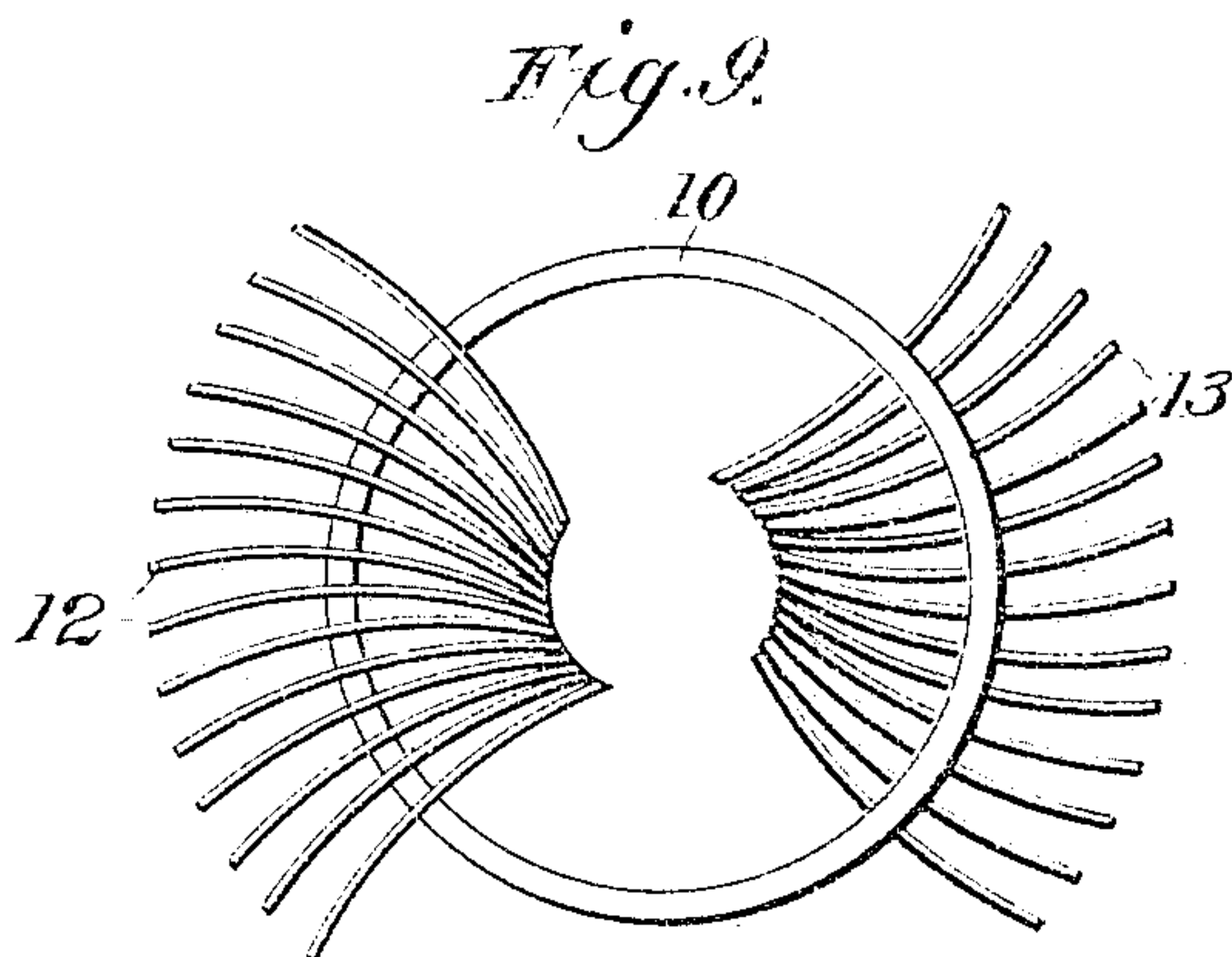
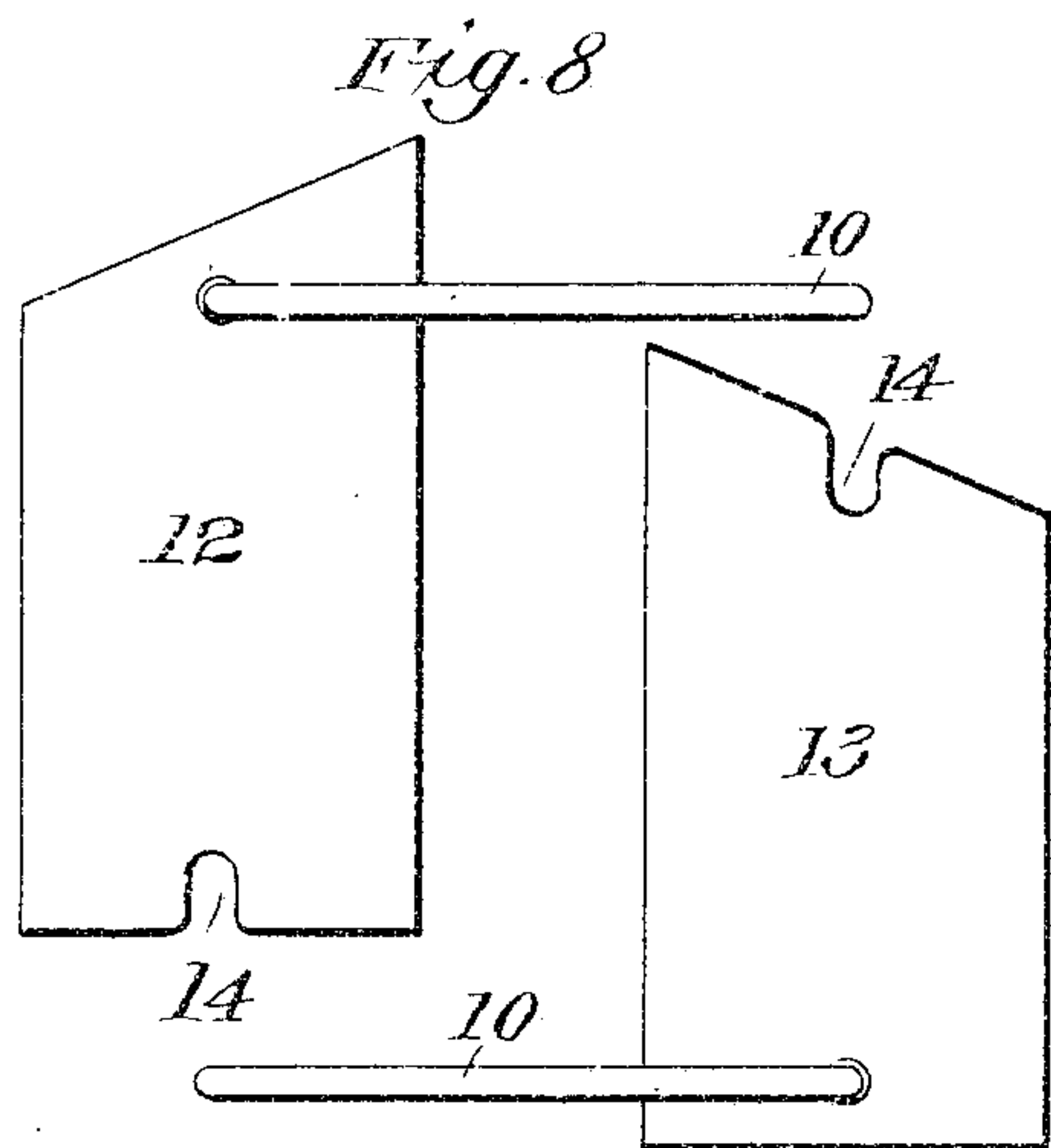
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APPLICATION FILED FEB. 5, 1904.

5 SHEETS—SHEET 5.

Fig. 13.

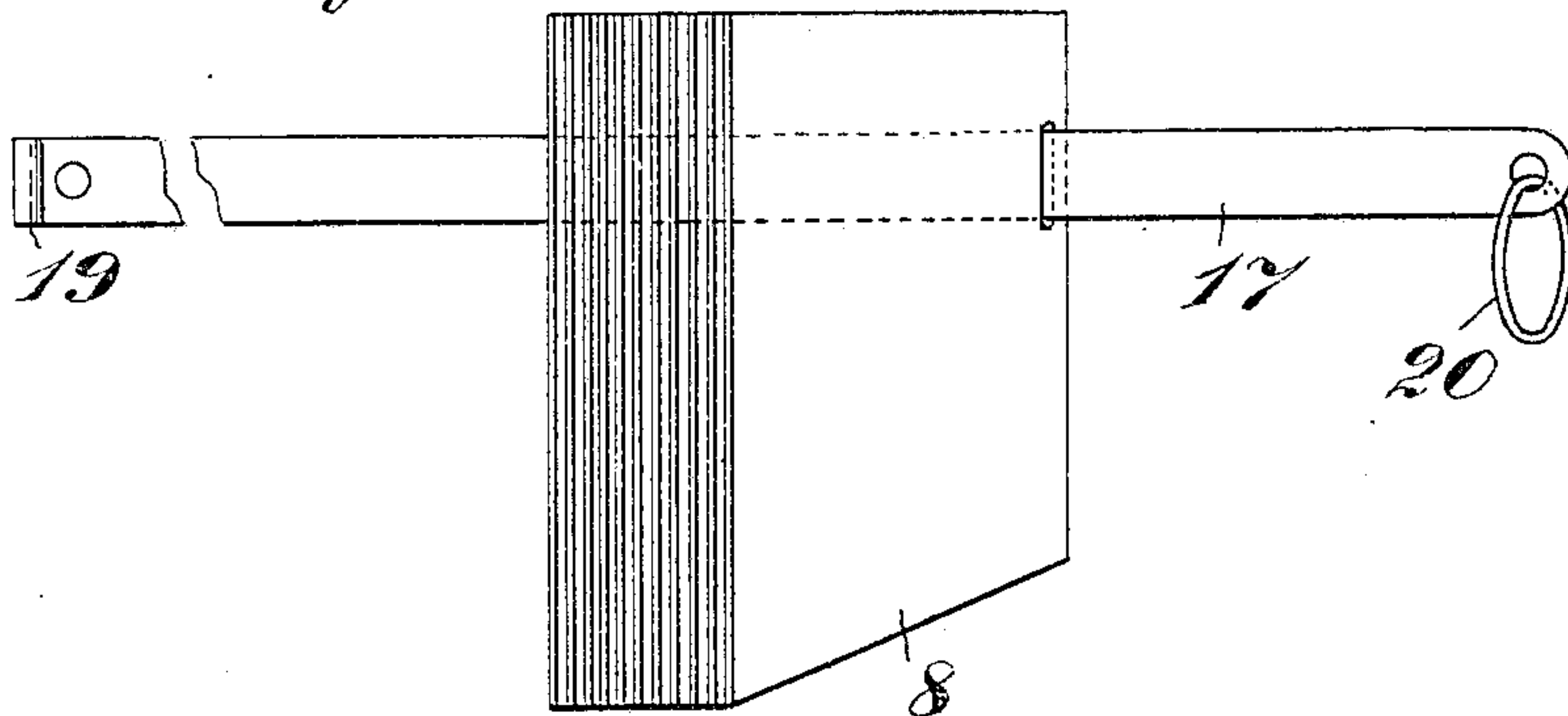


Fig. 14.

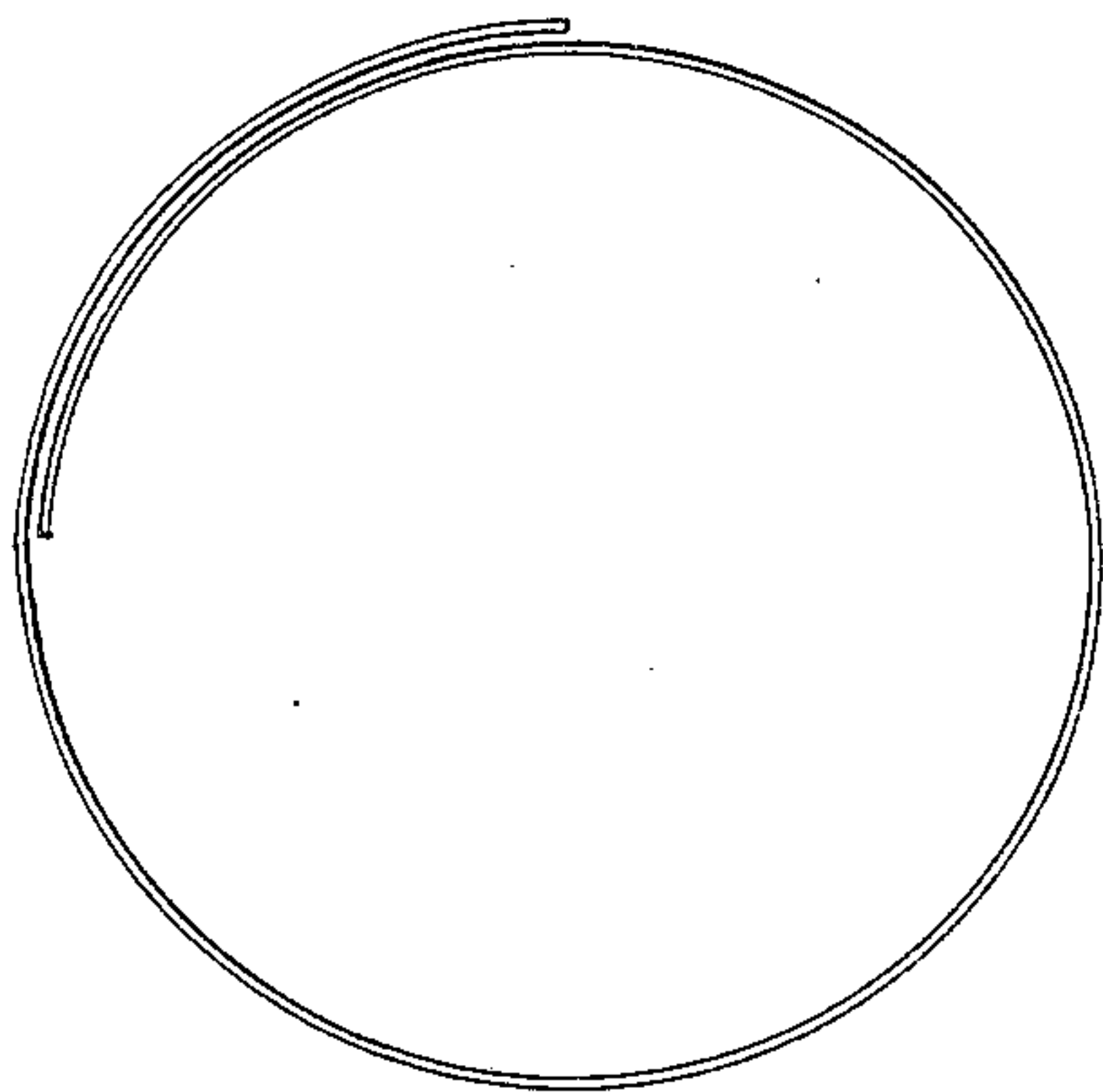


Fig. 15.

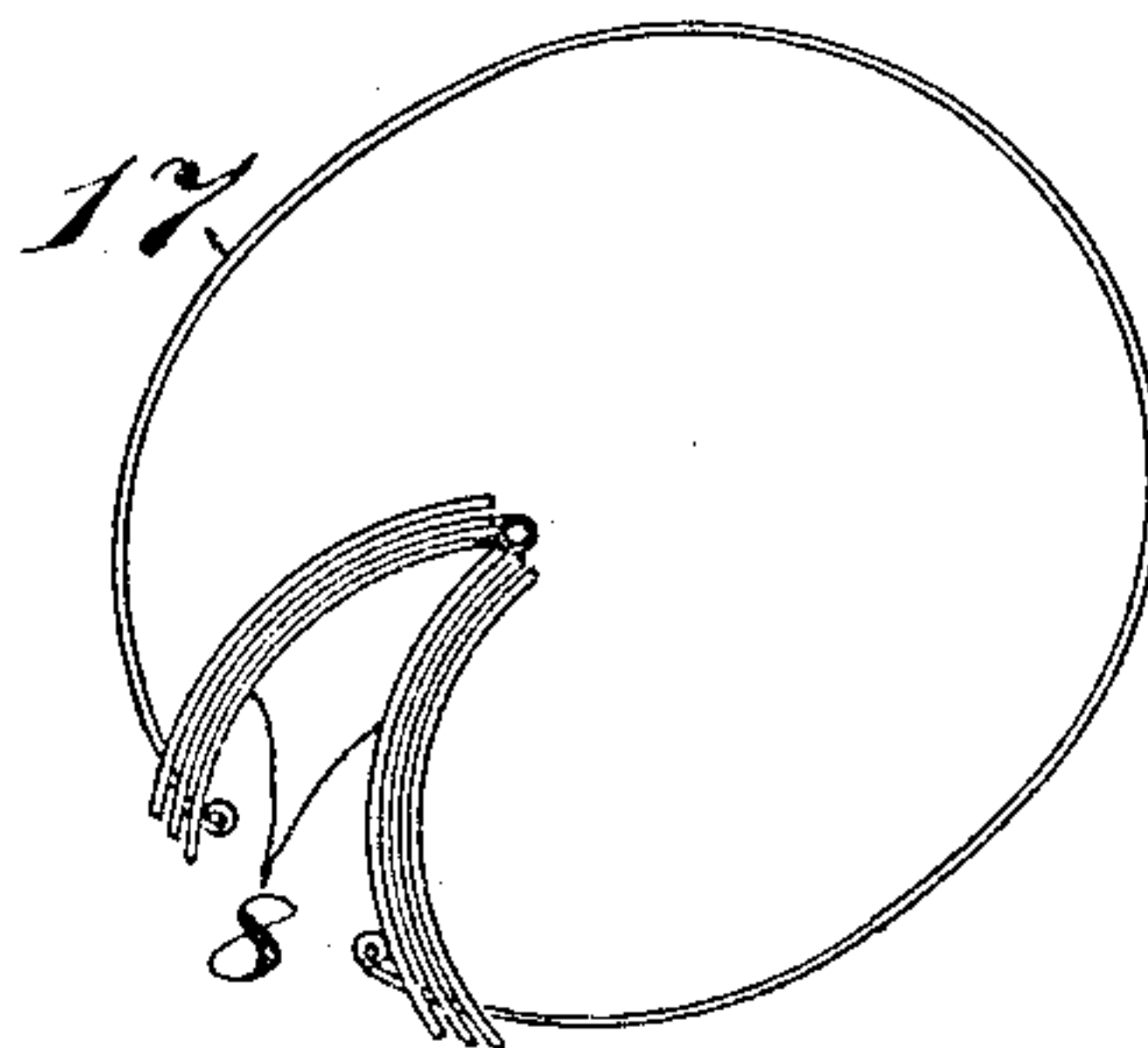
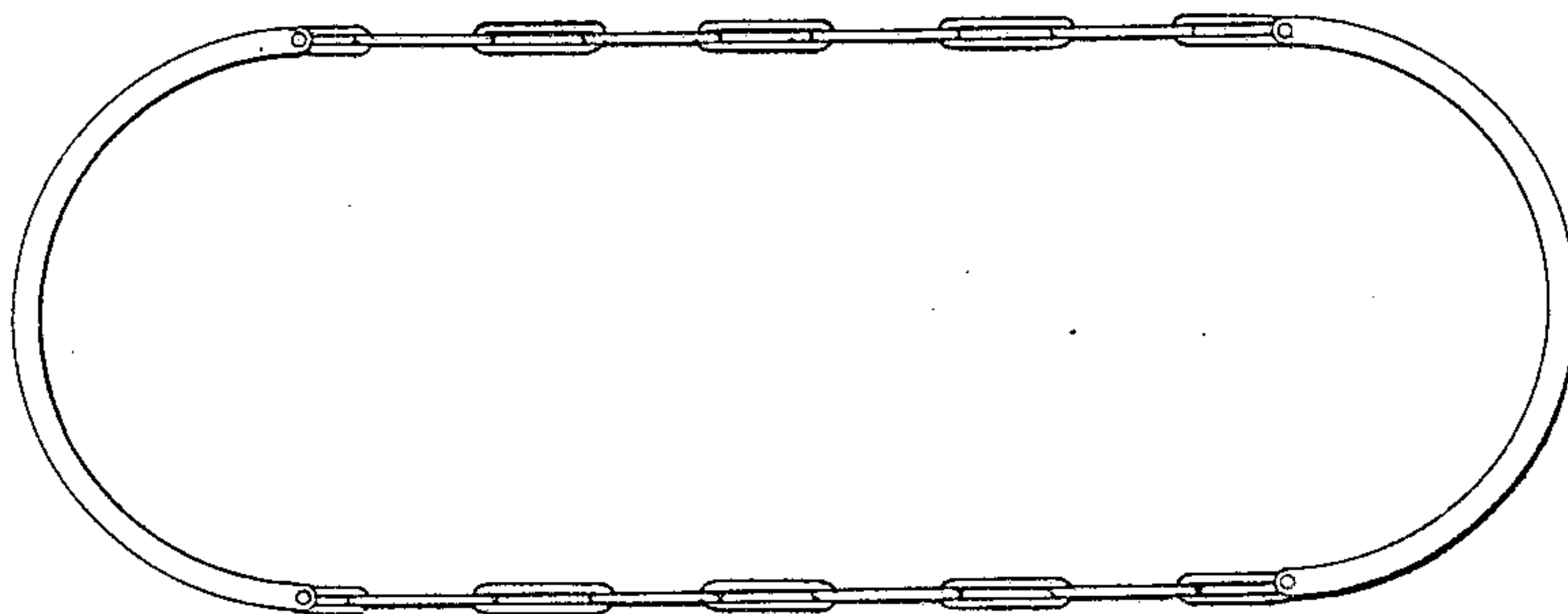


Fig. 16.



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UNITED STATES PATENT OFFICE.

CARL ALRIK HULT AND OSCAR WALFRID HULT, OF STOCKHOLM,
SWEDEN.

LINER FOR CENTRIFUGAL SEPARATORS.

SPECIFICATION forming part of Letters Patent No. 787,179, dated April 11, 1905.

Application filed February 5, 1904. Serial No. 192,143.

To all whom it may concern:

Be it known that we, CARL ALRIK HULT and OSCAR WALFRID HULT, subjects of the King of Sweden and Norway, and residents of Stockholm, Sweden, have jointly invented certain new and useful Improvements in Blade-Liners for Centrifugal Separators, of which the following is a specification.

This invention relates to improvements in blade-liners for centrifugal liquid-separators namely, in such liners where the blades are placed parallel or substantially parallel to the vertical axis of the bowl. Such liners have hitherto been constructed in several different ways concerning the manner of securing the individual blades, as well as concerning the shape of the latter. As known forms concerning the fastening of the blades may be mentioned the threading up of the blades on one or more rings fastening by means of hinges either with relation to themselves or to some central part, &c., and as known features concerning shaping of the blades may be mentioned making them plane and allowing them to assume radial positions in the bowl in relation to the shaft of the same or giving the blades a bent form or an angular form and allowing them to incline toward the radius of the drum. In all these cases an important desideratum—namely, the possibility of moving the one blade in relation to the other as a whole (consequently not only by means of swinging or turning, such as with the leaf in a book) in order to clean the liner—has not, so far as we are aware, been achieved. By a suitable choice of the aforesaid manners or shapes so that a new combination is formed an unanticipated good effect in the above-mentioned respect can be easily gained, so that the cleaning of the liner will not present the slightest difficulty. This constitutes the object of this invention, which consists in blades of bent or angular form being threaded on one or more rings. In consequence of this it is effected that the blades when they are placed in the drum, in consequence of their inclined position toward the ring, occupy in equal distri-

bution the entire length of the same, but when taken out of the drum can be pushed together on the ring, so that a greater part of the latter becomes unoccupied, whereupon the one blade after the other can be freely moved on the ring along the free portion of the same. The set of blades can now be separated anywhere and the parts each pushed in its direction on the ring. The latter can now, besides, if it is placed sufficiently near to one end of the blades and after the blades have been brought together, be turned upward, whereby the blades will be suspended on the same, like the keys on a key-ring. The bunch of blades, which are thereby spread downward, can thereupon be dipped and shaken in the cleansing fluid.

Instead of a closed ring a ring which is certainly closed, but is so constituted that it can be opened, or (in contrast to the closed ring) a non-endless easily-pliable metal band may be employed, which has the advantage that the length of the ring or band is independent of the width of the liner. A length of ring or band which is greater than the width of the liner can then be used, so that the blades can be moved still farther apart. It is otherwise not necessary for the band to always sit together with the plates; but, if so desired, it can be drawn out from the blades when they are mounted in the drum and the bands again threaded through the blades when they are to be taken out of the bowl, as is described hereinafter. By the blades not having any fixed points of attachment on the ring, the band, &c., but can move freely on the same, the blades can freely take up their position the one after the other without being prevented by the ring. The blades thereby come closer to each other, wherefore the entire number of blades can be considerably greater than has hitherto been the case. In order that the blades, however, shall not fall quite close together, they are provided at the upper and lower ends each with edgings on distancing-pieces. These edgings form thin partitions and serve at the same time to give the strength-

ened blade edge a rounded-off form, whereby the liner becomes easier to handle. Further, the introduction of the milk is arranged to advantage by means of the said edgings, so that the stream of liquid entering between the blades has no disturbing effect on the separation, owing to every space being filled at the most suitable point of the radius, caused by a portion of the edging being taken out at said point, so that an inlet-opening to the intermediate chamber is formed at one end of the liner.

Figure 1 in accompanying drawings shows the centrifugal drum with liner mounted in vertical center section, and Fig. 2 shows the same in horizontal section on the line A B in Fig. 1. Fig. 3 presents a side view of a blade, and Fig. 4 shows a blade in horizontal section. Figs. 3^a and 3^b show modifications. In Fig. 2 all the blades are not drawn, in order that the ring and the bottom of the bowl might be seen; but it is easily understood that the circular chamber in the bowl shall be filled with blades along the whole periphery. Fig. 5 shows a side view, and Fig. 6 a plan view, of the liner taken out of the bowl and the blades partly placed radially and pushed together on the ring. Fig. 7 shows the blades suspended like a bunch from the ring turned up in vertical position. Fig. 8 presents a side view of a modification consisting in the number of blades being divided into two sets each threaded on its ring. Fig. 9 shows same modification in plan. Fig. 10 shows that the ring can be constructed in such manner that it can be opened. Fig. 11 shows a blade with hole for threading said band through. Fig. 12 shows how the band can be threaded through the liner. Fig. 13 shows the band and some blades suspended thereon. Fig. 14 shows a modification consisting in the ring being formed by a wire spiral. Fig. 15 shows a modification consisting in the ends of the band being connected each one by its blade, which blades are connected at their inner edge. Fig. 16 shows a modification consisting in the ring composed of two or more parts being enlarged by means of inserted chains or the like.

The centrifugal bowl 1, Fig. 1, has cover and side in one piece and is held firmly pressed against the bottom 2 by the through-going shaft 3 and the nut 4, screwed on the same. At the top the shaft is hollow in order to form the ordinary inlet-pipe 5. Otherwise the drum is, as usual, provided with outlet-pipe 6 for the skim-milk and outlet-pipe 7 for the cream. On referring to Figs. 2 and 3 it will be seen that the bow-shaped and, at the outer edge, outwardly-bent blades 8 are provided with a hole 9, almost in the middle, near one end and threaded on a ring 10 of suitable size. The blades can when the liner is taken out of the bowl be freely moved on the ring. The

blades can consequently successively be easily brought in the position determined by their bending, as shown in Fig. 2, in order to form a cylinder corresponding to the inside of the bowl or be turned outward on the ring and successively pressed together, as seen to the left in Fig. 6. In the former case, Fig. 2, the blades are evenly distributed on the whole length of the ring, owing to the oblique position of the same; but in the latter case, Fig. 6, an excess of space on the ring is gained by the blades being pushed together on the ring, caused by the blade being brought in nearer coincidence with the radius of the ring. The one blade after the other can accordingly now be freely moved on the ring along the free portion of the same or the set of blades be anywhere separated or be opened and pushed to the sides when it is desired to isolate any certain blade. As the ring 10 is situated relatively close to one end of the set of blades, the same can after the blades have been placed together be turned upward to the position shown in Fig. 7. The blades then become freely suspended on the ring, like the keys on a key-ring. The set of blades can now be very easily dipped in the cleansing liquid and cleaned. The blades can easily be brought back in the position shown in Fig. 2 by placing the whole set on a plane surface, bringing down the ring 10 to horizontal position and by oblique pressure on the outer edge of the blades cause the blades to slide along the ring till they, evenly distributed on the same, form a cylinder. The blades can be made smooth or corrugated. To the left in Fig. 5 is shown a corrugation 11 running oblique to the radius for effecting canals leading to the outer periphery. The one blade can be smooth or have corrugations running in another direction than the next one, and so on.

According to Figs. 8 and 9 the blades are divided in two bunches 12 13, each bunch threaded upon its ring 10. In the one bunch the ring is situated near the upper and in the other bunch near the lower end of the set of blades. Further, each bunch is provided with a notch 14 on the blades at the opposite end. Both bunches can be threaded on each other's ring, as shown in Fig. 8, whereafter the bunches can be spread on both the rings, Fig. 9, as has been described above. This is accompanied with the advantage that the number of blades on each ring will be only half against when only one ring is used. Nevertheless there is nothing to hinder employing two or more such rings, as is shown in Figs. 1 and 2, preferably two, each situated close to its end of the liner.

An advantage in the construction described, Figs. 1 to 8, consists in the fact that the ring composed in suitable manner can easily be opened after the blades have been so brought

together that they only occupy a portion of the length of the ring and that subsequent to the opening the blades can be freely moved off and back again on the same—*e. g.*, for exchanging a damaged blade for a new one. For this purpose it is only necessary to make the ring of two or more parts 15 16, Fig. 10, connected at one of the ends by means of hinges and provided at the other ends with suitable hook or the like for the fastening together. Fig. 10 shows the ring opened. A ring formed by a wire coiled to a spiral form can also be employed, Fig. 14.

As mentioned above, a non-endless band or ring can also be used (in place of the ring 10) for the threading up of the blades. Such a band 17 (seen in Fig. 12) consists of a tolerably broad but very thin metal band, (steel band,) which is suitably threaded through the hole 18 near the outer edge of the blade. The position of the hole can obviously be varied.

In order that the blades threaded on may not be able to slide off the band when the liner is taken out of the bowl, one end of the same can be rolled up into a curl or be provided with a knob or the like 19 and its other end provided with a hole for the threading through of a ring 20 or the like, which can serve as a kind of lock, Fig. 13. By holding the ring or both ends of the band the liner can thus be easily dipped in the cleansing fluid and the blades shaken. When the liner shall be mounted in the bowl, it is rolled together to a cylinder and is pushed a short distance in the bowl. If it be desired to allow the band to remain, the ring 20 is removed, the one end of the band is put on the inside of the other end of the band, and the former is pushed in through the blades until the whole band forms a spiral ring, as schematically shown in Fig. 14, whereupon the liner is wholly pushed in the bowl. After the liner is taken out of the bowl the same straightens itself out owing to the springing property of the band. By means of the ring 20 both ends of the band, if so desired, can be connected, so that the band forms a wide ring. After the liner has entered a short distance in the bowl, as is above mentioned, the band can also be drawn out and the liner thereupon be entirely pushed in. When the liner is taken out of the drum, it is first moved forward only so much that the holes 18 become accessible, whereupon the band is threaded in through the blades. This threading through (shown in Fig. 12) is easily effected through the end of the band having a bow-like form in accordance with the circle of the liner. In order to avoid obscurity, large spaces are shown in Fig. 12 between the blades. In Fig. 13 all the blades are not shown either. One or more bands can also be used provided

with a curl or the like at both ends, and the blades can always remain on the band. A wire open annular spring or the like can also be employed instead of band.

The modification in Fig. 16 consists in the ring 10 being composed of two semicircular-shaped pieces which can be separated and joined together by means of chains or the like, as shown in the said figure. A chain or the like can, obviously, also be placed in between the free ends of the ring in the ring shown in Fig. 10 in order to obtain in its entirety a relatively large closed ring on which the blades can be moved far apart. It may likewise be remarked that the closed ring, Figs. 1 to 9, can obviously consist of a chain, flexible connector, or the like. A tensile ring can also be employed.

Another form of construction consists in the blades being threaded on the band, chain, string-shaped part, &c., at the outer edge and in the first and last blades being hinge-like, connected with each other at the inner edge. In order to clasp the liner together, the ends of the band can be hooked together by means of some suitable arrangement. The first and the last blades will then form extensions of the band when it is opened. As the blades can freely slide on the ring, band, &c., they will be able to fall quite close together. In order to prevent this, the upper and lower ends of the blades are provided with edgings 21, which serve as sliding-surfaces when the blades are being spread and as thin interpositions, whereby small spaces result between the blades about equal to a blade thickness. The edging consists of a double folded plate-strip fitted on the edge of the blade, Figs. 1 to 3. It can also consist of a single strip, Fig. 3^a, or be effected by bending over the edge of the plate, Fig. 3^b.

In Figs. 1, 3, and 4 it will be seen how an opening 22, leading to the intermediate chamber, is effected by a portion of the edging being absent on one side of the plate 8. The whole milk enters through this opening to the intermediate chamber. The opening is so situated on the blade that it comes opposite the neutral layer of milk in the liner—*i. e.*, the layer where the milk has the same specific weight as the whole milk flowing into the bowl. Said layer is denoted in Fig. 4 by means of two dotted circles and designated by 23. In order to create a passage for the whole milk to all the openings 22, the bottom of the bowl is provided with a ring-shaped depression 24, concentric with the axis of the bowl, and a collar 25, mounted on the pipe 5. The outward-folded lower outer edge coincides or substantially coincides with the inner edge of the openings 22, while the periphery of the depression 24 suitably coincides with the outer edge of the openings 22. The whole

milk is introduced into the pipe 5, passed out through holes 26 of the same within the collar, under the edge of the collar, which rests on small raised projections, and through the openings 22, up between the blades, where in the usual manner the cream passes along one side of the blade in toward the center of the bowl and the skim-milk passes out along the other side of the blade toward the periphery of the bowl. As the said leading up of the whole milk is effected in line with the neutral layer, as mentioned above, the same has no disturbing action on the said flow of the cream and the skim-milk. It is obvious that there is nothing to hinder a portion of the edging being absent on both sides of the blade 8, whereby the opening 22 receives the same size transversely as the intermediate chamber between the blades, and the blade itself can likewise be notched. The method of conducting the whole milk through the openings 22, which can even be effected at the top of the liner, can obviously be arranged in various ways. For instance, the collar 25 can be substituted with an expansion on the pipe 5 or the like. The bending of the blades 8 can obviously be varied, and likewise the blades can be made of an angular shape.

It will be understood from the above description that we do not claim the hinging in some manner of radially-disposed blades of a liner on a connecting ring or annulus. This is already known, and it does not get the utility and convenience for cleansing that we attain by our construction. The main feature of our liner is the threading of the blade connector or ring, whether it be stiff, flexible, or springy, loosely through blades disposed in the drum or bowl obliquely to the radii of the latter, whether they be plane, curved, or angular blades, so that when the liner is lifted out for cleansing room will be provided on the connector for shifting and separating the blades to facilitate washing, as clearly illustrated in Figs. 6, 7, and 12.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A liner for a centrifugal separator, having a series of blades disposed in a circle and obliquely to the radius of the said circle, and an annular guide and connector on which said blades are loosely threaded, the blades being slidable on said ring so as to be adjustable toward and from each other.

2. A liner for a centrifugal separator, having a plurality of blades slidably connected together by a blade-connector and intersecting the radii of the inclosing bowl, said connector being threaded through the several blades and openable to permit of inserting its end through said blades.

3. A liner for a centrifugal separator, having a plurality of blades intersecting the radial

line of the inclosing bowl, and a blade-connector made up of two or more articulated parts and threaded through the several blades, the latter being freely slidable along the connector.

4. A liner for a centrifugal separator, having a plurality of blades intersecting the radii of the containing-bowl, and a blade-connector threaded through holes in the several blades, said holes being situated near the outer edges of the blades.

5. A liner for a centrifugal separator, having a plurality of substantially upright blades intersecting the radial line of the bowl, and a blade-connector threaded through coincident apertures in the several blades, said connector being of ring-like form and the blades being freely slidable along the same.

6. A liner for a centrifugal separator, having a plurality of blades intersecting the radial line of the bowl, and a blade-connector threaded through coincident apertures in the blades near their outer edges, the end blades of the series being connected at their inner edges and the blades being slidable along the connector.

7. A liner for a centrifugal separator, having a plurality of substantially upright blades intersecting the radial line of the bowl, and a flexible blade-connector threaded through coincident apertures in the said blades, said apertures being situated near the outer edges of the blades.

8. A liner for a centrifugal separator, comprising a plurality of upright blades intersecting the radial line of the bowl, and having distancing-edgings on their upper and lower ends, and a blade-connector slidably threaded through said blades.

9. A liner for a centrifugal separator, having a plurality of substantially upright blades intersecting the radii of the inclosing bowl, said blades having means for distancing them and ways or apertures at their lower edges for the flow of the liquid beneath, and means for slidably connecting the blades.

10. A liner for a centrifugal separator, having a complete set of substantially upright blades intersecting the radii of the inclosing bowl, means carried by the blades for spacing or distancing them, and a blade-connector threaded through coincident apertures in the blades, and inclosed at its ends, the said blades being slidable on the connector.

11. Means for the purpose specified, comprising a bowl provided at its bottom with a depression 24, a central inlet-pipe provided with holes 26, a plurality of upright blades intersecting the radii of said bowl, said blades having distancing-edgings and passages at their lower edges for the milk, and a blade-connector which slidably connects the blades of the series.

12. Means for the purpose specified, com-

prising a bowl provided with an inlet-pipe 5, having apertures 26, an annular depression 24 in its bottom, and the collar 25, a plurality of upright, curved blades intersecting the radii of the inclosing bowl, said blades having distancing-edgings, and passages formed in their lower edges, and means for slidably connecting together the said blades.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

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OSCAR WALFRID HULT.

Witnesses:

ERNST SVANQUIST,

AUG. SORENSEN.