

No. 630,363.

Patented Aug. 8, 1899.

A. E. KRAUSE.

FILTER.

(Application filed July 13, 1898.)

(No Model.)

4 Sheets—Sheet 1.

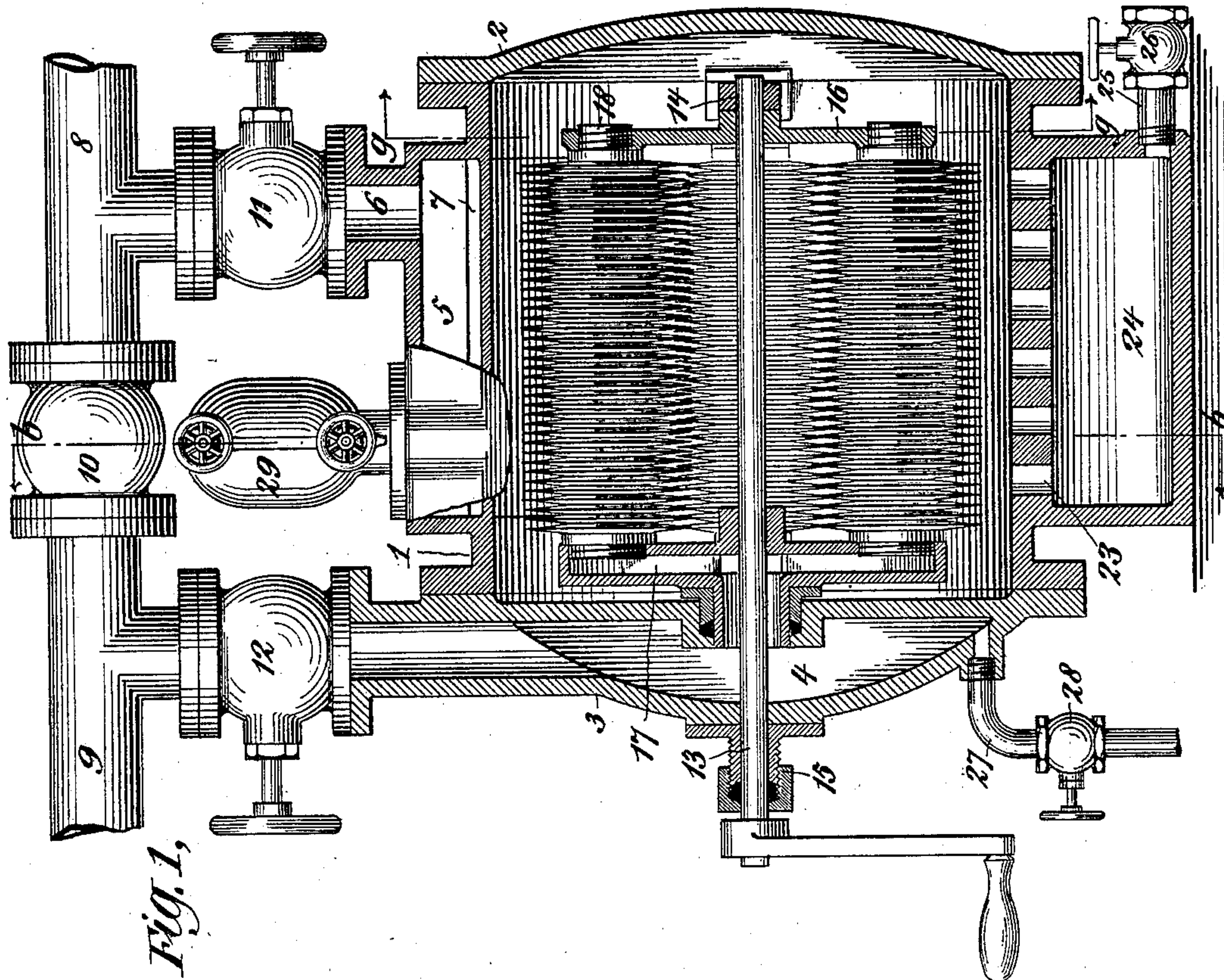


Fig. 1,

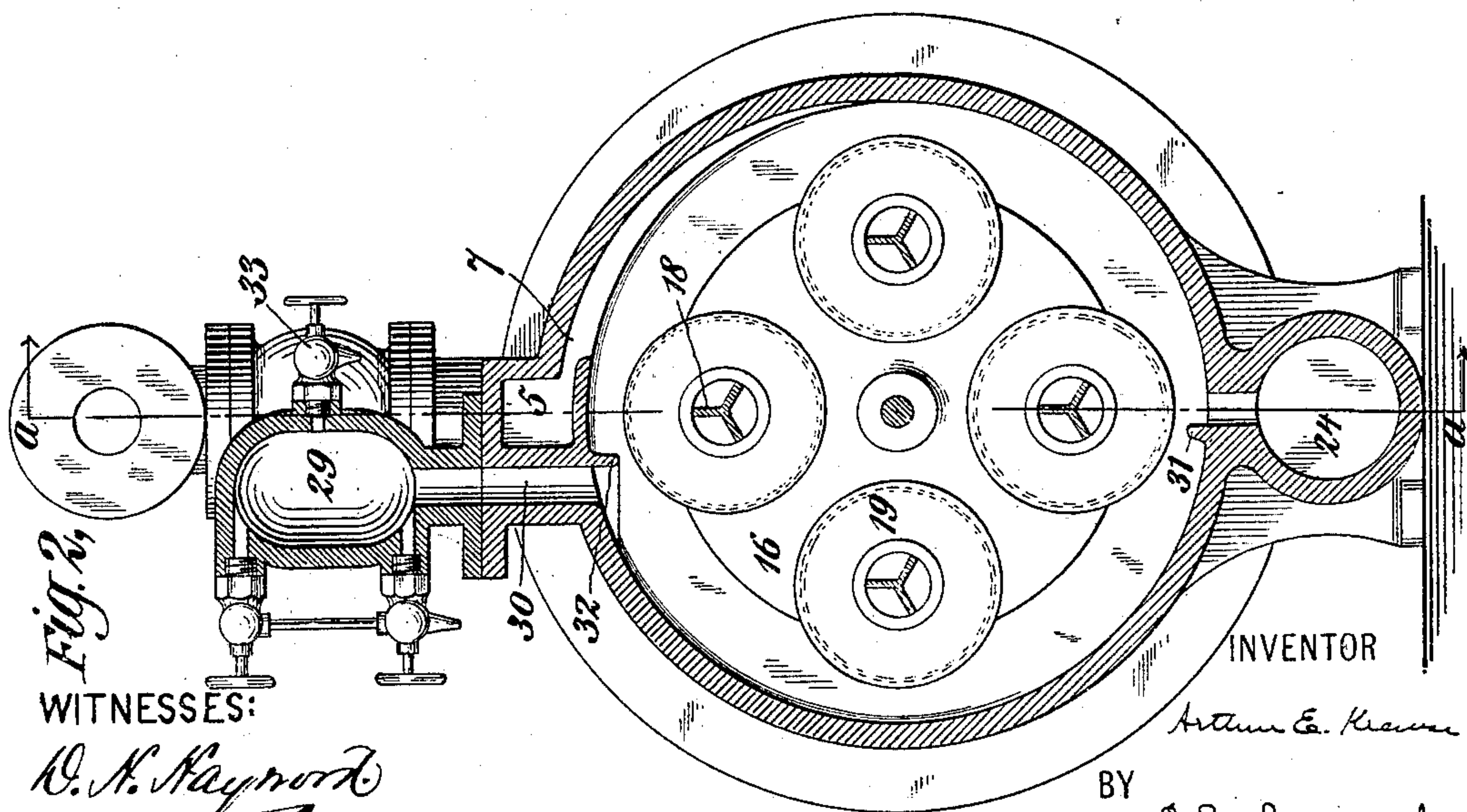


Fig. 2,

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No. 630,363.

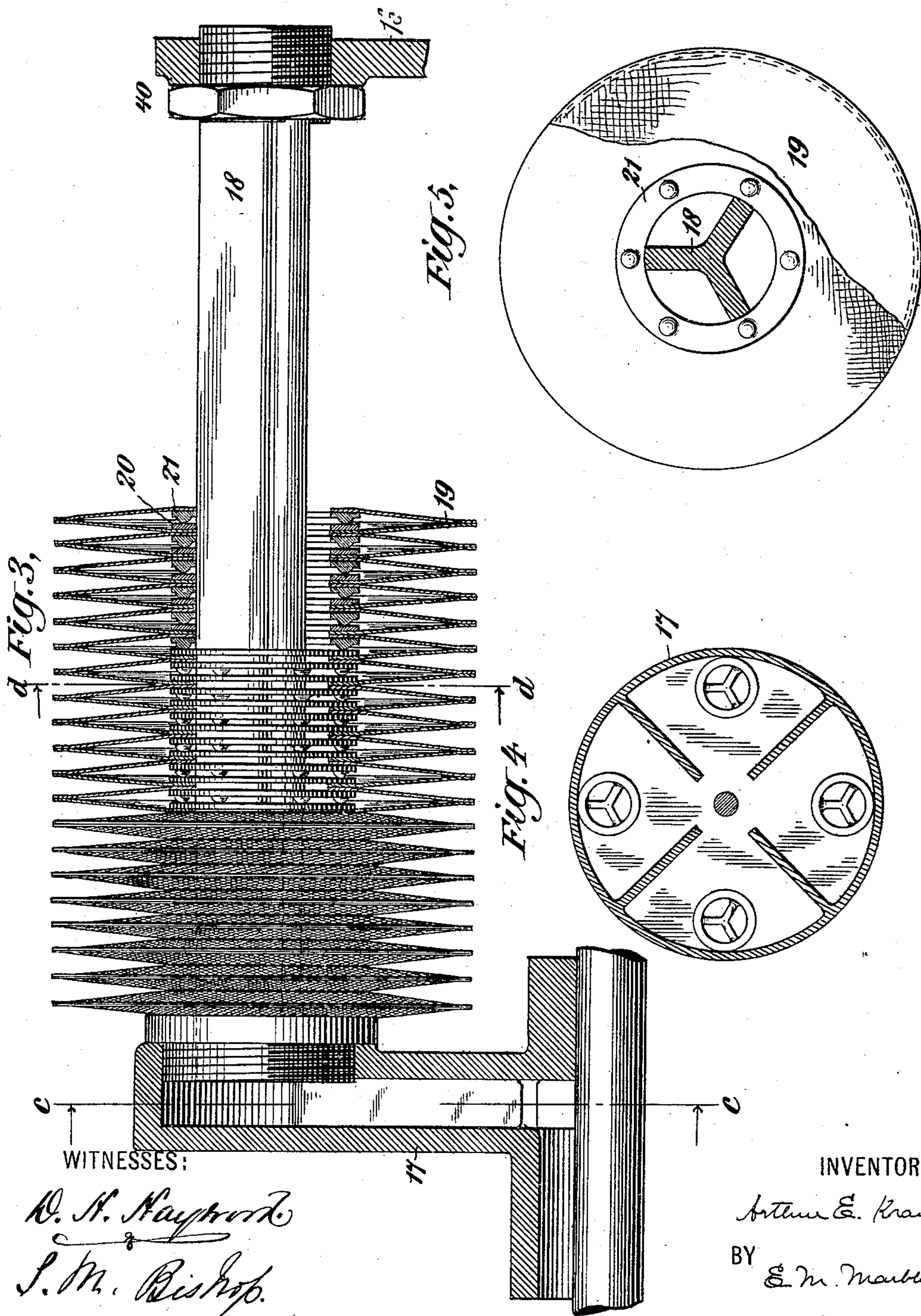
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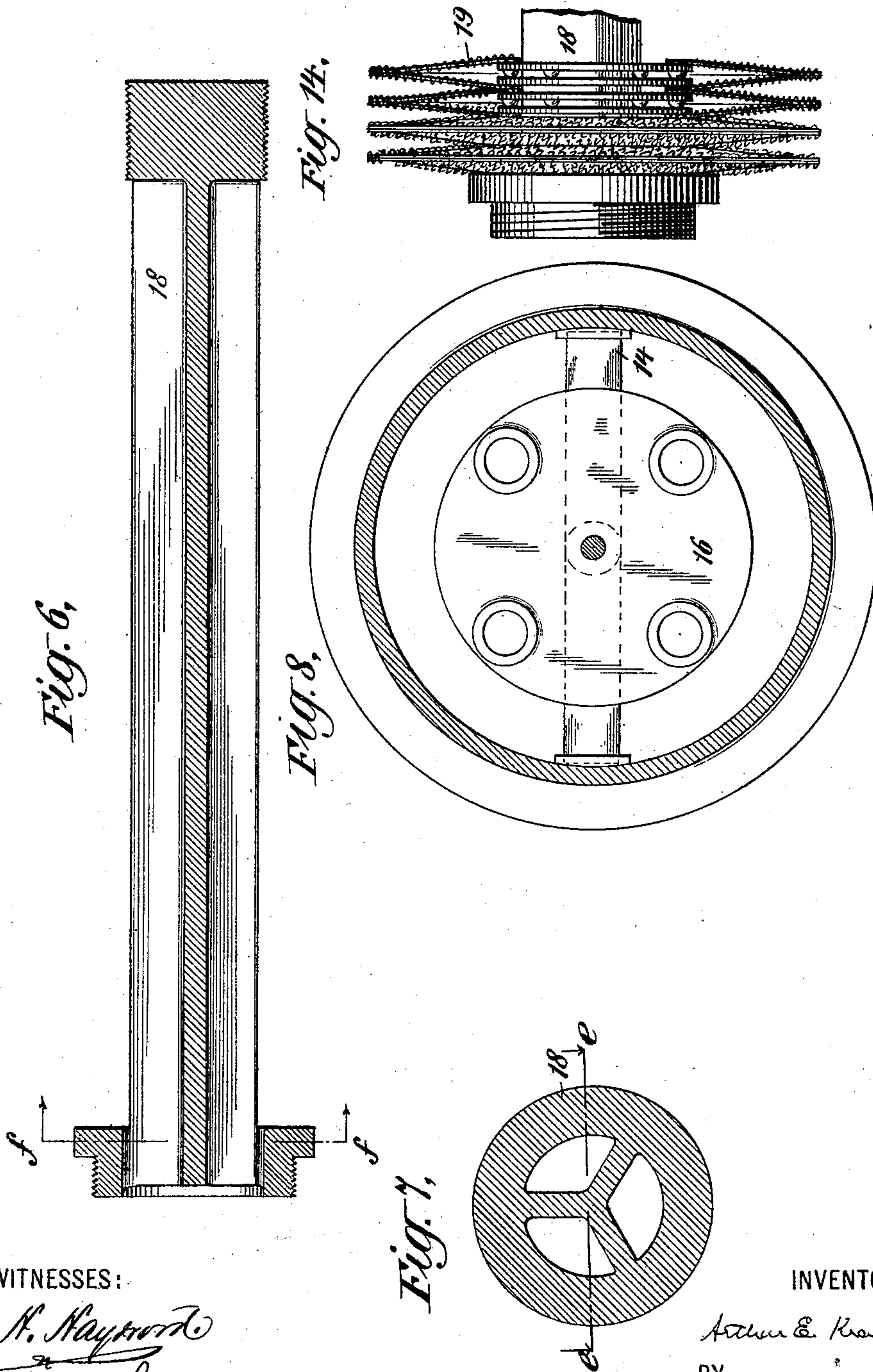
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(No Model.)

4 Sheets—Sheet 3.



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Patented Aug. 8, 1899.

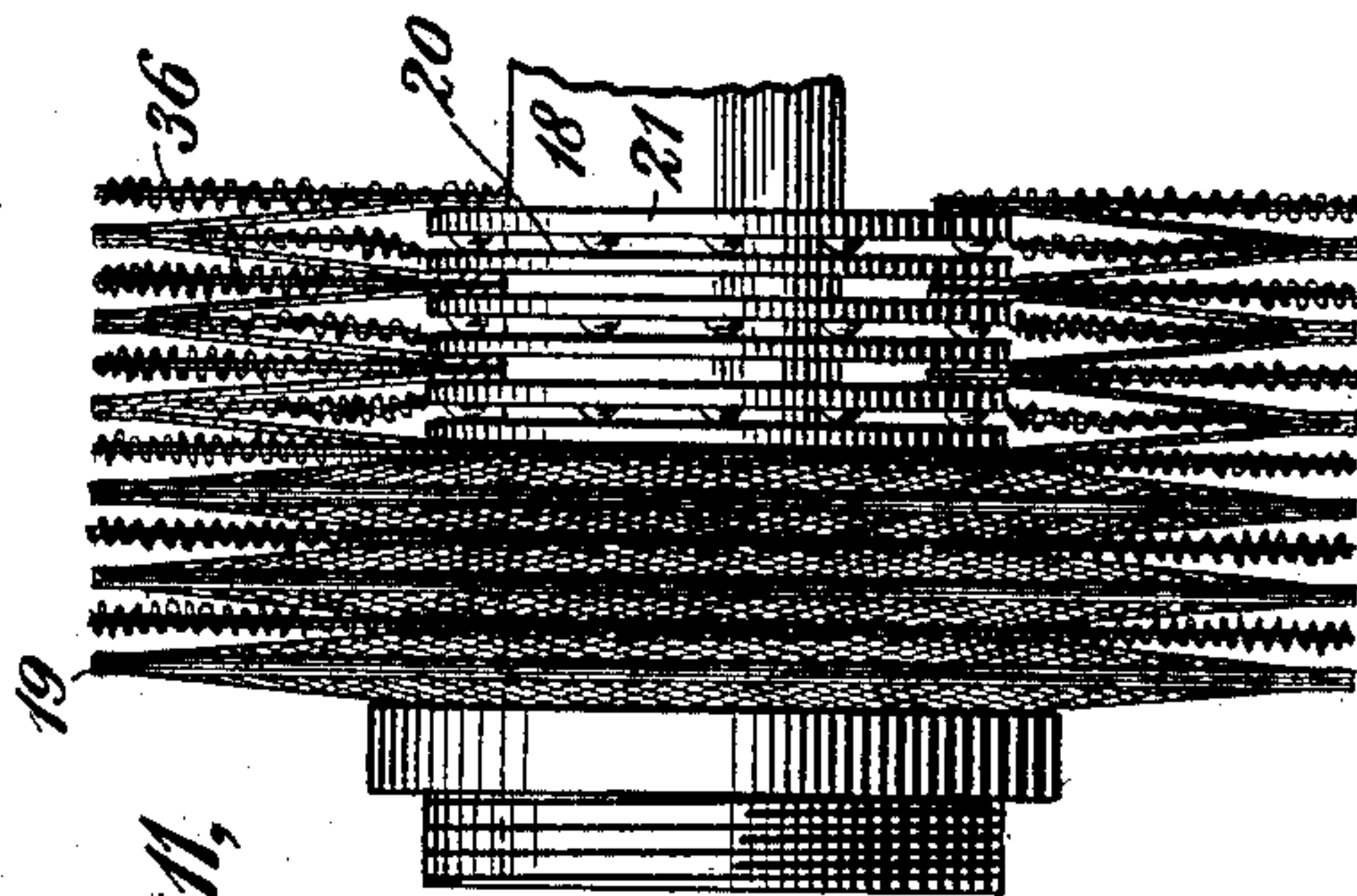
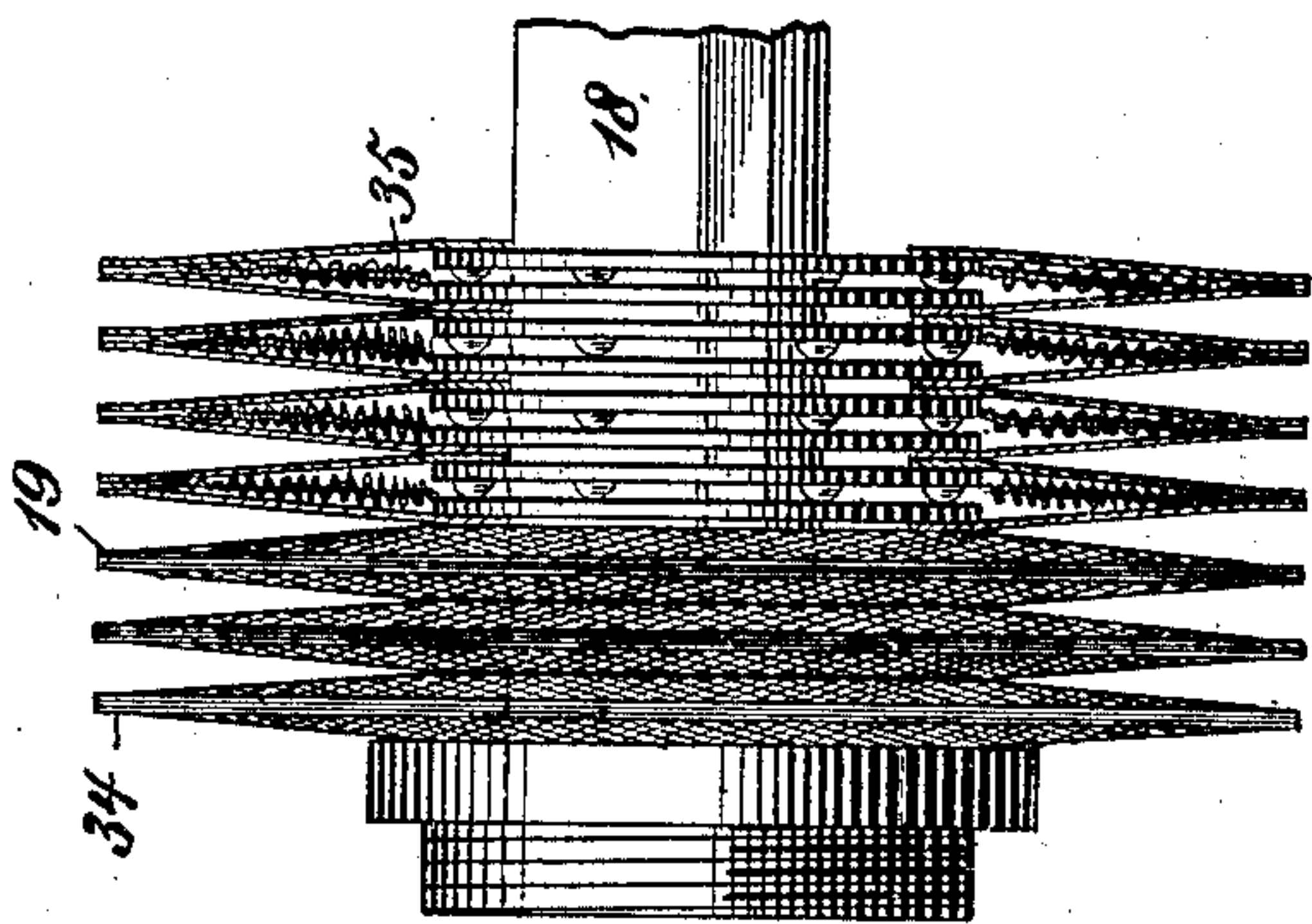
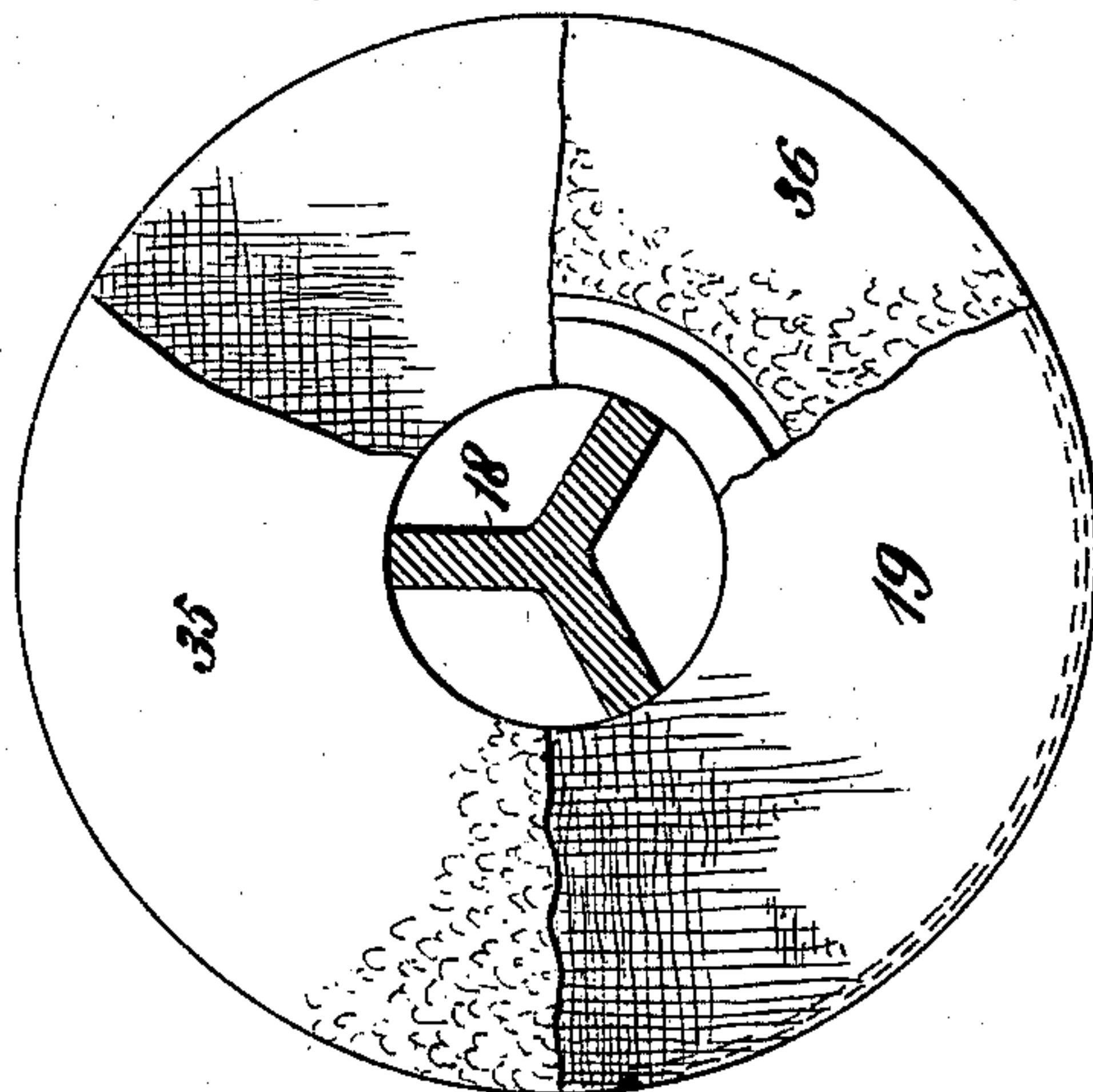
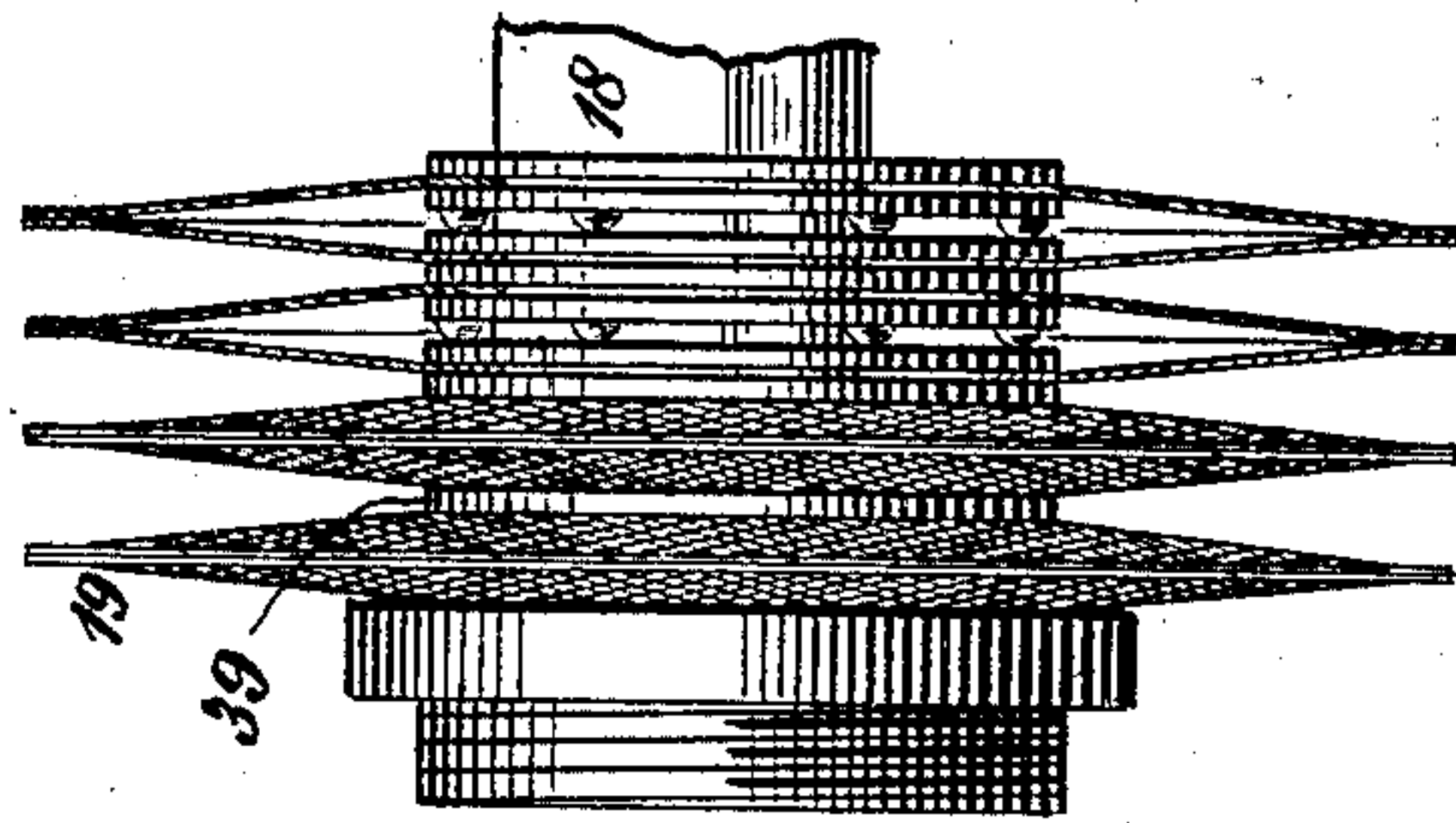
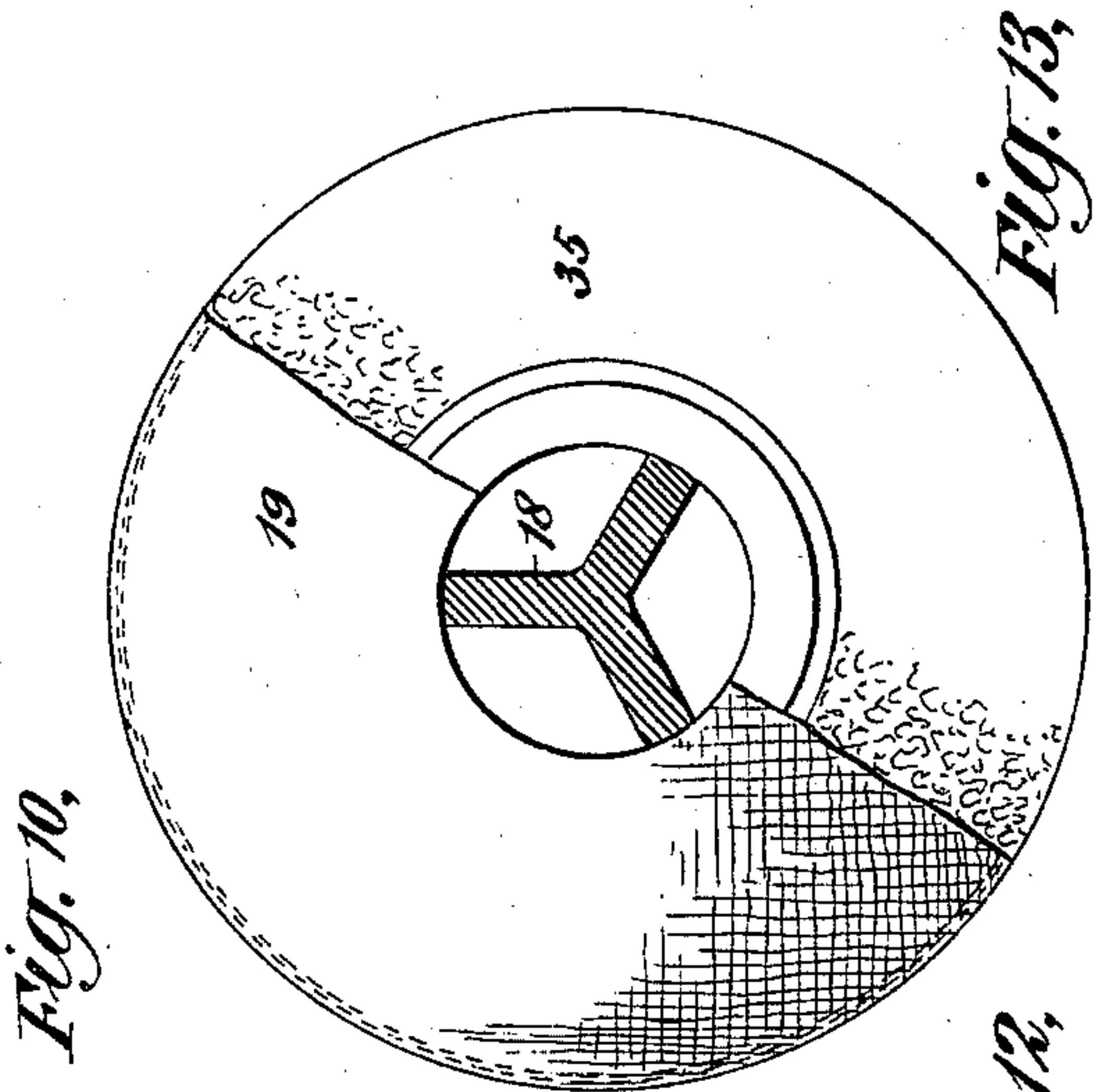
A. E. KRAUSE.

FILTER.

(Application filed July 13, 1898.)

(No Model.)

4 Sheets—Sheet 4.



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ARTHUR E. KRAUSE, OF JERSEY CITY, NEW JERSEY.

FILTER.

SPECIFICATION forming part of Letters Patent No. 630,363, dated August 8, 1899.

Application filed July 13, 1898. Serial No. 685,816. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR E. KRAUSE, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Filters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it ap-
10 pertains to make and use the same.

My invention relates to filters, and particularly to filters designed for removing oil from boiler feed-water, although the improved filter herein described is also applicable to the
15 removal of sand, sediment, and impurities generally from water and to the filtration of all other fluids.

My invention consists in a novel arrangement of filter-bags within the filter, in the
20 novel means employed for supporting said bags and carrying off the filtrate, in the novel means provided for maintaining passages through which the unfiltered liquid may reach all portions of the filtering-surfaces and
25 through which the filtrate may escape, in the novel manner of introducing the unfiltered liquid into the filter so as to avoid the settling of sediment upon the filter-bags, in the novel means employed for cleansing the filter with-
30 out removing the bags therefrom, and generally in the novel combination, construction, and arrangement of the parts.

The objects of my invention are, first, to provide a filter particularly adapted for the
35 removal of oil from feed-water, but likewise adapted for general filtration, and which is compact and contains a very large filtering-surface in proportion to its size; second, to so arrange the filtering material or medium
40 that all portions of such medium shall be equally and highly efficient; third, to provide an improved construction and arrangement of filter-bags and improved means for supporting the same, maintaining passages for
45 the unfiltered and filtered liquids, and carrying off the filtrate; fourth, to provide means for preventing, so far as possible, the settling of sediment upon the filter-bags; fifth, to provide means for cleansing the filter, and, sixth,
50 to so construct the filter that it shall be durable, easily operated, easily cleaned, readily taken apart and put together, and compara-

tively inexpensive. These objects are attained in the filter herein described, and illustrated in the drawings which accompany and
55 form a part of this specification, in which the same reference-numerals indicate the same or corresponding parts, and in which—

Figure 1 is a vertical longitudinal section of the filter through the center thereof, taken
60 on the line *a a* of Fig. 2, looking in the direction of the arrows. Fig. 2 is a vertical transverse section of the filter, taken on the line *b b* of Fig. 1, looking in the direction of the arrows. Fig. 3 is a detail view showing one
65 of the filter-bag carriers with a number of bags thereon, some of which are sectioned, and showing also in section the header into which the filtrate from the various series of filter-bags is discharged. Fig. 4 is a vertical
70 transverse section, on the scale of Figs. 1 and 2, of this header, the section being taken on the line *c c* of Fig. 3, looking in the direction of the arrows. Fig. 5 is a vertical transverse
75 section of one of the filter-bag carriers, taken on the line *d d* of Fig. 3, looking in the direction of the arrows, the front layer of fabric of the filter-bag shown being broken away to show the bossed spacing-ring within the bag. Fig. 6 is a detail central longitudinal sectional
80 view of one of the filter-bag carriers, taken on the line *e e* of Fig. 7. Fig. 7 is a transverse sectional view of one of the filter-bag carriers, taken near the discharge end of the carrier, on the line *f f* of Fig. 6. Fig. 8 is a
85 transverse section of the filter on the line *g g* of Fig. 1, looking in the direction of the arrows, showing the rear support of the filter-bag carriers and the bracket in which the shaft of the filter has one of its bearings. 90
Figs. 9 to 14, inclusive, are detail views of the filter-bags and the parts in proximity thereto, showing different means which may be employed for preserving passages for the un-
95 filtered and filtered liquid to and from the filtering-surfaces. Fig. 9 shows edge and sectional views of a number of filter-bags, each composed of two outer layers of cloth and a third inner layer of some fabric having a
100 "pile" on each surface, such as Turkish towel-
ing or terry cloth. Fig. 10 is a transverse section of a filter-bag carrier, showing a face view of one of the filter-bags of Fig. 9, the outer layer of fabric having been broken away

to show the inner layer of piled fabric. Fig. 11 is a view similar to Fig. 9, but showing bags which have between them a layer of piled fabric. Fig. 12 is a view similar to Fig. 10, showing a face view of one of the filter-bags of Fig. 11, the various layers of fabric of this bag having been broken away to disclose the layers of piled fabric interposed between said bag and the next succeeding bag. Fig. 13 is a view similar to Fig. 9, showing external spacing-rings between the filter-bags; and Fig. 14 is a view similar to Fig. 9, showing filter-bags made from a piled fabric, such as Turkish toweling.

In the drawings, 1 is the main or central portion of the casing of the filter.

2 and 3 are end pieces, 3 having cored out in it a chamber 4, into which the filtrate passes, as hereinafter described.

5 is a chamber cored out in the top of the section 1 and may be termed a "distribution-chamber," since it serves to distribute the entering liquid over substantially the whole length of the filtering-chamber. It has an opening 6, communicating with the supply-pipe, and a port 7, extending its whole length, communicating with the filtering-chamber and discharging the entering fluid tangentially into the filtering-chamber, as shown in Fig. 2.

8 is a supply-pipe which carries the liquid to the filter, and 9 is a discharge-pipe. The supply and discharge pipes are preferably connected by a by-pass provided with a valve 10, which is kept closed normally. Valves 11 and 12 are also interposed between the supply and discharge pipes, respectively, and the filter, and these valves are kept open while the filter is in operation.

13 is a central shaft extending from the discharge end of the filter, through both walls of the end piece 3, into and through the main or filtering chamber of the filter and having bearings in a bracket 14 at the right-hand end of the filter and also in the outer wall of the end piece 3, where a stuffing-box 15 is provided. This shaft carries a plate 16 and a header 17, which together support a series of filter-bag carriers 18, upon which a series of disk-like filter-bags 19 are mounted.

The filter-bag carriers 18 have a spider-like section, as shown in Figs. 2, 4, and 5, thus having recesses in their sides, which, with the filter-bags themselves, form channels for the passage of the filtrate. They might be perforated tubes; but when constructed as shown they may be cast and require no boring or machine-work other than the screw-threading of their ends. The side recesses of these carriers are continued through their enlarged left-hand ends, as shown in Figs. 6 and 7, so that the filtrate may be discharged into the interior of the header 17.

The filter-bags are composed of two or more layers of cloth or other suitable material having central openings, so that they may slip over the carrier 18, and sewed or woven to-

gether at their outer edges. Within each bag are two spacing-rings, one, 20, having a plane surface and the other, 21, having a series of bosses, so that openings for the passage of filtrate from the interior of the bags to the channels in the sides of the carriers 18 are left between the rings. These spacing-rings serve to separate the sides of the filter-bags for the purpose of affording free passage to the filtrate as it passes from the inner surfaces of the bags to the channels in the carriers 18.

As already stated, the header 17 has an internal chamber. The header has also a hub revolubly mounted in the inner wall of the end piece 3, being surrounded by a stuffing-box, and this hub has an opening through which the shaft 13 passes, but which is considerably larger than said shaft, so that the filtrate entering the interior of the header 17 passes through the opening in the hub thereof into the chamber within the end piece 3.

A crank 22 is provided for rotating the shaft 13.

In the bottom of the main casing 1 of the filter are a series of openings 23, leading to a sediment-chamber 24, cored out in the bottom of the casing 1 or otherwise connected thereto. From this chamber sediment may be drawn from time to time through a pipe 25, provided with a suitable valve 26. The pipe 25 and valve 26 may serve also as a means for emptying the main chamber of the filter. A pipe 27, having a valve 28 and connected with the filtrate-chamber 4, is provided also to facilitate the cleansing of the filter-bags, as hereinafter described. At the top of the filter there is a scum-chamber 29, connected with the interior of the filter through a passage 30.

As already stated and as shown in Fig. 2, the water enters the filtering-chamber in a tangential direction, tending therefore to circulate within the chamber in a rotary manner. Such circulation tends to prevent the collection of sediment upon the filter-bags. This circulation also assists in the collection of scum in the scum-chamber 29 and also in the collection of sediment in the sediment-chamber 24, for just beyond the openings 23, leading to the sediment-chamber, and just beyond the mouth of the passage 30, leading to the scum-chamber, are projections or fins 31 and 32, which intercept sediment and scum carried by the water and direct the sediment into the sediment-chamber and the scum into the scum-chamber.

The scum-chamber is provided with a gage-glass and with a cock 33, through which scum may be drawn off.

The filter-bags 19 are each composed of two layers of cloth, sewed or otherwise secured together at the edges and provided with central apertures in order that they may slip over the filter-bag carriers. The bags may be either round, as shown, square, or of any other shape desired. The bags may be made of cotton twill, having a coarse thread interwoven

into the meshes, so that separate channels are formed for the unfiltered liquid to find its way over the entire surface of each bag when the bags are in place upon the carriers, as also to form similar channels within the bags, so that the filtered liquid may pass into the side channels of the filter-bag carriers. To further facilitate the passage of the unfiltered liquid through the interior of each bag, the bags may be provided with internal layers of a fabric, such as that known as "Turkish toweling," which has a pile on each surface. Figs. 9 and 10 illustrate this construction. The bags there shown have each an interior layer 35 of fabric having a pile. The piled fabric keeps the outer layers of the filter-bag apart, and the spaces between the fibers of the pile permit passage of the filtered fluid. Layers of piled fabric may also be interposed between the several bags to assist in preserving passages through which the unfiltered liquid may reach the sides of the filter-bags. Figs. 11 and 12 show this construction. The layers of piled fabric between the filter-bags are numbered 36. In this case a finer filtering-cloth may be used for the bags, the interior and exterior layers of toweling providing for the free passage of the liquid both to and from the filtering-surfaces.

Before placing the bags upon their carriers each bag has inserted into it two spacing rings or washers 20 and 21, one of these rings, as 21, being provided with bosses on the side adjacent to the other ring, so as to provide openings through which liquid within the filter-bags may pass into the side channels of the filter-bag carriers. When the bags are in place on their carriers, they are pressed together and against the spacing-rings by compression-nuts 40, so that direct passage of unfiltered liquid between the bags into the channels of the carriers is prevented.

The character of the fabric used in the making of the bags and the use of layers of toweling within the bags or between them depends upon the character of the fluid to be filtered and the impurities carried thereby. If the fluid carries an exceedingly fine sediment, then cloth of close mesh may be required. If the surface of the cloth is smooth, it may be necessary or desirable to interpose between the bags spacing-rings 39, as shown in Fig. 13.

It will be obvious from the above that in these various combinations of bags, spacing-rings, and interior and exterior layers of rough-surfaced fabric a filtering-cloth of any degree of fineness may be used, the coarse piled fabric acting simply as a means for giving the liquid to be filtered and the filtrate free access to and from the filtering-surfaces, which otherwise would lie so closely together as to prevent the passage of such liquids or would clog up.

In particular cases, as in Fig. 14, the bag is made of a material having a sufficiently fine body, but having also on both sides a pile,

which obviates the necessity of using interior and exterior separating-cloths of piled fabric.

The operation of the filter is as follows: Water or other fluid entering the chamber 5 passes out through the port 7 into the main or filtering chamber of the filter, being projected in a tangential direction. The water within this main chamber percolates through the sides of the filtering-bags into the interior thereof and then passes into the side channels of the filter-bag carriers, flowing into the interior of the header 17. It then passes through the hollow hub of this header into the chamber 4 in the end piece 3 and then passes out. In passing through the filter-bags sediment and impurities carried by the liquid are caught. The rotary circulation of the fluid within the main chamber of the filter, due to the projection of said fluid in a tangential direction from the admission-port 7, tends to prevent the collection of sediment or scum upon the surface of the filter-bags and to wash such impurities from said bags. The heavy impurities are carried by centrifugal force to the sides and bottom of the filter, and being intercepted by the fin 31 pass downward into the sediment-chamber 24. The lighter impurities and scum pass to the top of the liquid within the filter and are intercepted by the fin 32, passing up into the scum-chamber 29. Filtration continues in this manner until through the collection of sediment and impurities upon the surface of the filter-bags and in their pores the filtration becomes too slow to be efficient. The filtering-surfaces may then be cleaned by revolving the bags by means of the crank 22. During this operation the inlet and outlet valves 11 and 12 may be closed, and the impurities washed off from the bags and which pass into the sediment-chamber 24 may be drawn off by opening the cock 26. At the same time the scum within the chamber 29 may be drawn off by opening the cock 33. After the bags have been cleaned in this manner the supply and outlet valves may be opened and filtration continued, as before. In order to facilitate rapid cleaning of the bags, steam or any suitable fluid may be introduced into the filter in a reverse direction through the pipe 27, the washing medium thus admitted passing into the header 17 and thence into the interior of the filter-bags and out through their pores, thus serving to release impurities held in the pores of the bags or upon their outer surfaces. The muddy liquid is then discharged through the valve 26, the operation being thus continued until the bags are clean.

When it is necessary to renew the bags, the end piece 2 at the right-hand end of the filter is removed, together with the bracket 14, in which the right-hand end of the shaft 13 has its bearing, and the plate 16. The filter-bag carriers, with the bags thereon, may then be removed by unscrewing them from the header 17 and drawing them out. The filter-bags may be removed from their carriers by un-

screwing the nuts 40 and slipping the bags off. By a reverse operation the filter-bags may be put in place on their carriers and the carriers reassembled in the filter. For feed-
 5 water filters a number of carriers and filter-bags mounted thereon may be kept in readiness to be inserted immediately, so as to save time necessary for mounting new bags upon carriers.

- 10 The arrangement of the filter-bags herein employed—viz., transverse bags mounted in series upon carriers provided with means for carrying off the filtrate—possesses many advantages over the arrangement of bags em-
 15 ployed heretofore. A much greater amount of filtering-surface in proportion to the space occupied is obtained, the bags being smaller are not so likely to burst, and the liability of the bags to rupture is farther reduced, owing
 20 to the fact that the pressure is from the outside inward. Furthermore, since the impurities are deposited upon the outside of the bags the bags may be more readily cleaned in place without removing them from the fil-
 25 ter than is possible with the ordinary arrangement of filter-bags.

The bags are mutually supporting when in use and require no internal stiffening device to prevent them from falling over sidewise
 30 to such an extent as to interfere with filtration.

Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

- 35 1. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through which the carrier passes, and means for preventing passage of unfiltered fluid between
 40 the bags into the filtrate, substantially as described.
2. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through
 45 which the carrier passes, and having fluid-tight joints about the edges of said openings to prevent the passage of fluid between the bags into the filtrate, substantially as described.
- 50 3. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through which the carrier passes, and having fluid-tight joints about the edges of said openings
 55 to prevent the passage of fluid between the bags into the filtrate, and means for preserving passages within the bags through which fluid may flow, substantially as described.
- 60 4. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through which the carrier passes, means for pressing together the surfaces of adjacent bags about
 65 said openings, so as to prevent the passage of fluid between the bags into the filtrate, and means for preserving passages within the

bags through which fluid may flow, substantially as described.

5. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse
 70 filter-bags mounted on said carrier, and forming therewith channels through which fluid may flow, with which channels the interiors of said bags are in communication, substantially as described.

- 75 6. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through which the carrier passes, and having water-tight joints about the edges of said openings
 80 to prevent the passage of fluid between the bags into the filtrate, said bags and carrier together forming channels through which fluid may flow, substantially as described.

- 85 7. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, having openings through which the carrier passes, means for pressing together the sides of adjacent bags about said
 90 openings, so as to prevent the passage of fluid between the bags into the filtrate, and means for preserving passages within the bags through which fluid may flow, said bags and carrier together forming passages through
 95 which fluid may flow, with which passages the interiors of said bags are in communication, substantially as described.

8. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse and mutually-supporting filter-bags thereon,
 100 substantially as described.

9. In a filter, the combination, with a filter-bag carrier, of a series of separate transverse filter-bags thereon, each composed of a plu-
 105 rality of layers of fabric separate from the fabric of the adjacent bags, and provided with openings through which the carrier passes, substantially as described.

10. In a filter, the combination, with a filter-bag carrier, of transverse filter-bags mounted
 110 upon said carrier, spreading-rings within said bags, and means for pressing the bags and rings together, substantially as described.

11. In a filter, the combination, with a filter-bag carrier, of transverse filter-bags mounted
 115 on said carrier, spreading-rings within said bags which provide passages through which fluid may pass, and means for pressing the bags and rings together, substantially as described.

12. In a filter, the combination, with a filter-bag carrier, of transverse filter-bags mounted
 120 upon said carrier, spreading-rings within said bags, one of the rings of each bag having projections with intermediate passages upon the face adjacent to the other ring, and means
 125 for pressing the bags and rings together, substantially as described.

13. A filter-bag consisting of a plurality of layers of fabric, one or more of which have a
 130 piled surface, said layers of fabric being secured together at their edges and having cen-

tral openings through which a filter-bag carrier may pass, substantially as described.

14. A filter-bag consisting of two outside layers of fabric and an inside layer having a piled surface, secured together at their edges and having central openings through which a filter-bag carrier may pass, substantially as described.

15. In a filter, the combination, with a filter-bag carrier, of a series of separate contiguous and mutually-supporting transverse filter-bags mounted upon said carrier, and means for preserving passages between the bags through which fluid may flow, substantially as described.

16. In a filter, the combination, with a filter-bag carrier, of a series of separate and contiguous filter-bags thereon having openings in their sides through which the carrier passes, and means for preserving passages between the surfaces of said bags through which fluid may flow, substantially as described.

17. In a filter, the combination, with a filter-bag carrier having a series of separate transverse filter-bags mounted thereon, the interior surfaces of each bag, and the exterior surfaces of adjacent bags, being in supporting contact with one another, and means for preserving passages between such surfaces for the passage of fluid, substantially as described.

18. In a filter, the combination, with a filter-bag carrier, of transverse filter-bags mounted upon said carrier, and layers of piled fabric interposed between said filter-bags, substantially as described.

19. In a filter, the combination, with a filter-bag carrier adapted to carry a series of transverse filter-bags and having in its sides grooves or channels adapted to communicate with the interiors of said bags, of a series of transverse filter-bags mounted upon said carrier, and means for preventing fluid from passing between the bags into the filtrate, substantially as described.

20. In a filter, the combination, with a casing inclosing a filtering-chamber, of a rotatable shaft within said casing and projecting therefrom, and filter-bag carriers and bags thereon carried by said shaft, and connected at one end to a header connected with a suitable receptacle, substantially as described.

21. In a filter, the combination, with a casing containing a filtering-chamber and a chamber for receiving the filtrate, of a shaft rotatably mounted within said filtering-chamber, and filter-bag carriers and filter-bags thereon supported from said shaft, and communicating at one end with a header communicating with said filtrate-chamber, substantially as described.

22. In a filter, the combination, with a casing having a main or central portion and end pieces inclosing a filtering-chamber, one of said end pieces having within it a chamber for receiving the filtrate, of a shaft projecting through said filtrate-chamber into the filtering-chamber, and rotatably mounted, and filter-bag carriers and filter-bags thereon supported from said shaft and communicating at one end with a header mounted upon said shaft and having a hollow hub projecting through the inner wall of the end piece containing the filtrate-chamber, whereby said header communicates with said filtrate-chamber, substantially as described.

23. In a filter, the combination, with a casing containing a filtering-chamber and provided with a distributing-chamber, connected to the filtering-chamber by a port arranged to project the fluid in a substantially tangential direction, whereby rotary circulation of the fluid within the filtering-chamber is maintained, of filtering devices within said chamber, and means for carrying off the filtrate, substantially as described.

24. In a filter, the combination, with a casing containing a filtering-chamber and provided with a distributing-chamber, connected with the filtering-chamber by a port arranged to project fluid in a substantially tangential direction, said casing also being provided on its lower side with a sediment-chamber and on its upper side with a scum-chamber, and fins for deflecting the sediment and scum into said chambers, of filtering devices within the filtering-chamber, and means for carrying off the filtrate, substantially as described.

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

ARTHUR E. KRAUSE.

Witnesses:

HARRY M. MARBLE,

RITA BRADT.