

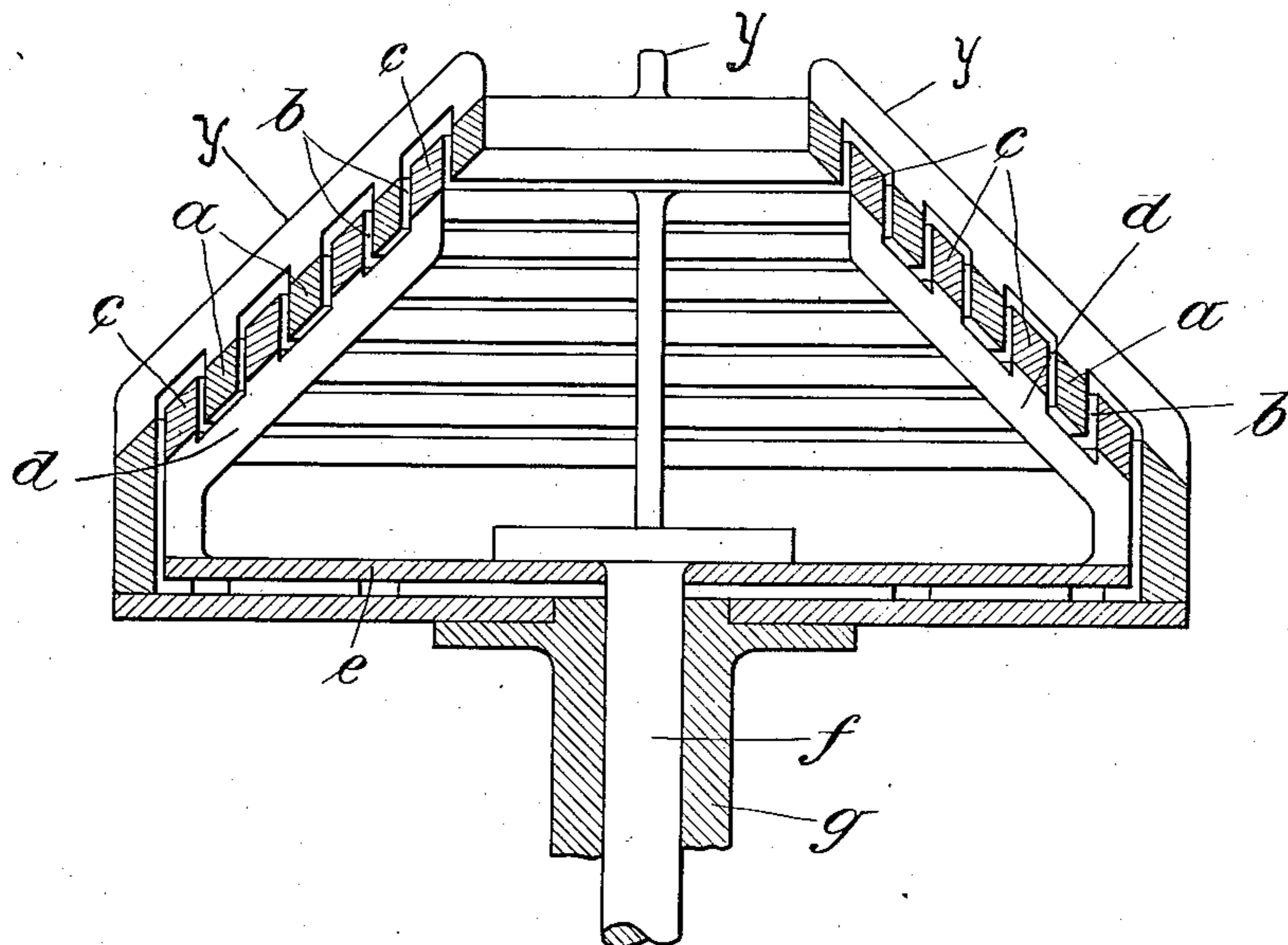
No. 891,271.

PATENTED JUNE 23, 1908.

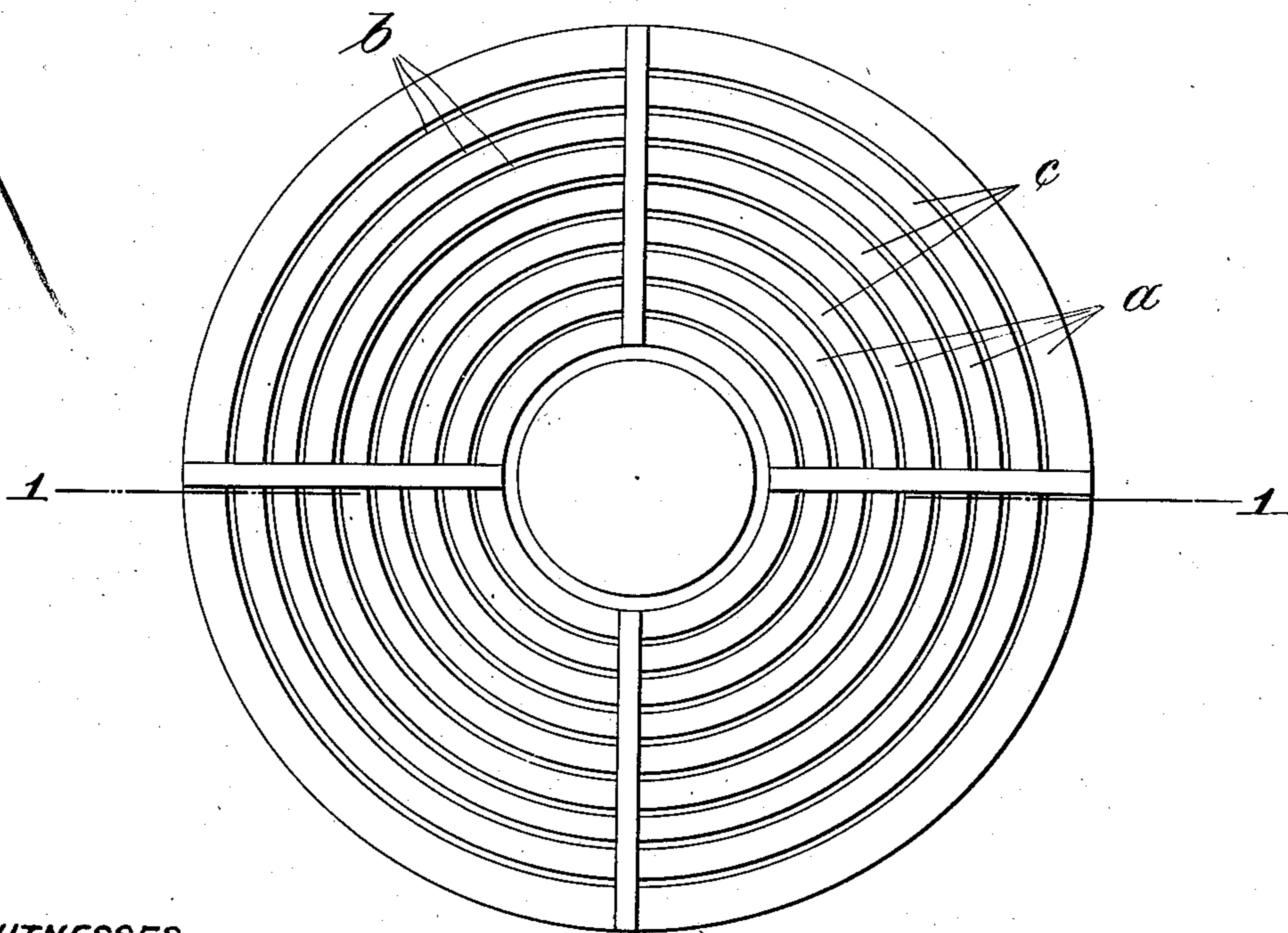
B. LJUNGSTRÖM.  
CENTRIFUGAL MACHINE.  
APPLICATION FILED JUNE 26, 1906.

4 SHEETS—SHEET 1.

*Fig: 1.*



*Fig: 2.*



WITNESSES:

*M. M. Hamilton*  
*E. E. Hall*

INVENTOR

*Björge Ljungström*

BY

*Nacless & Harding*  
ATTORNEYS.

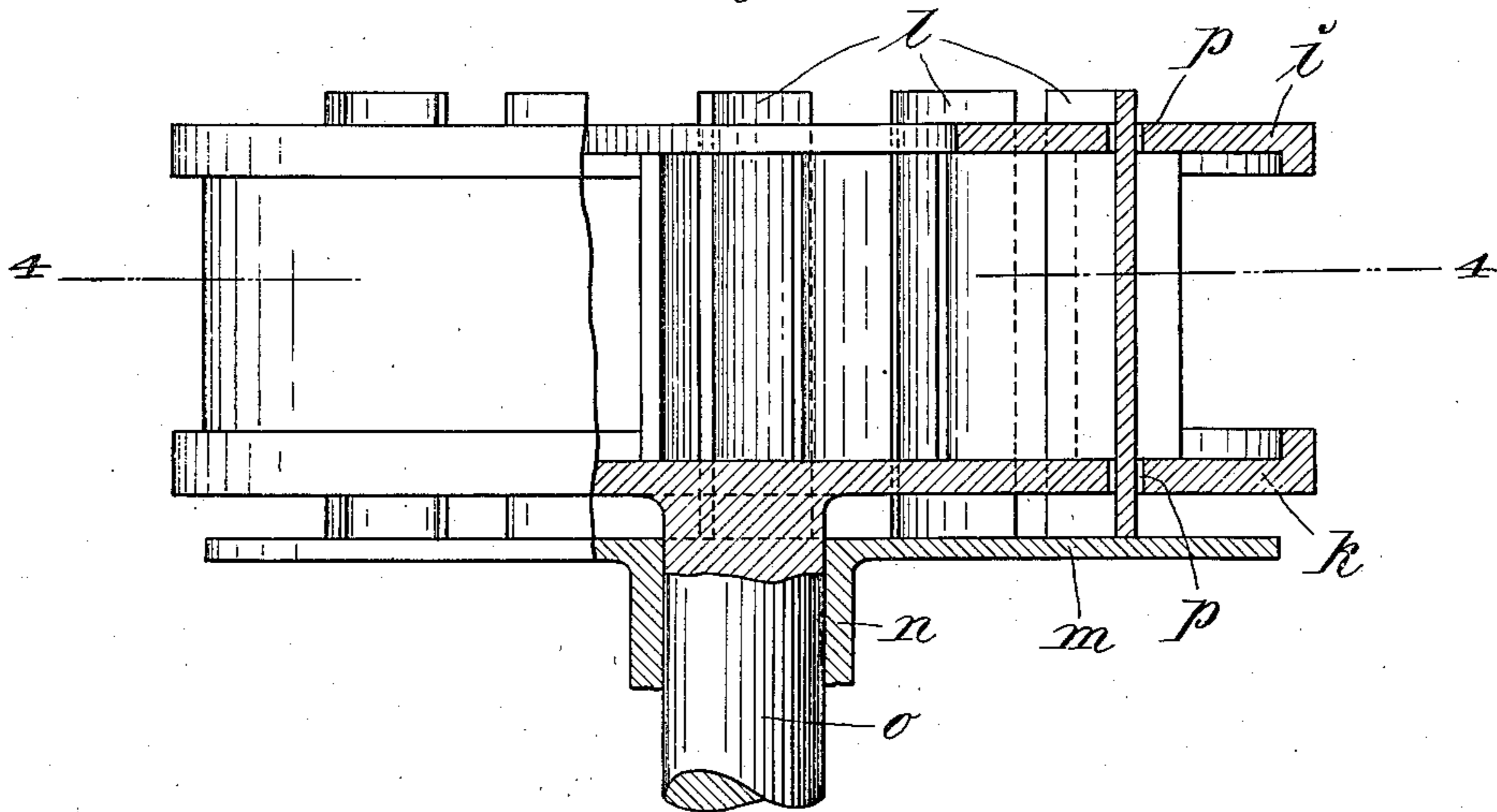
No. 891,271.

PATENTED JUNE 23, 1908.

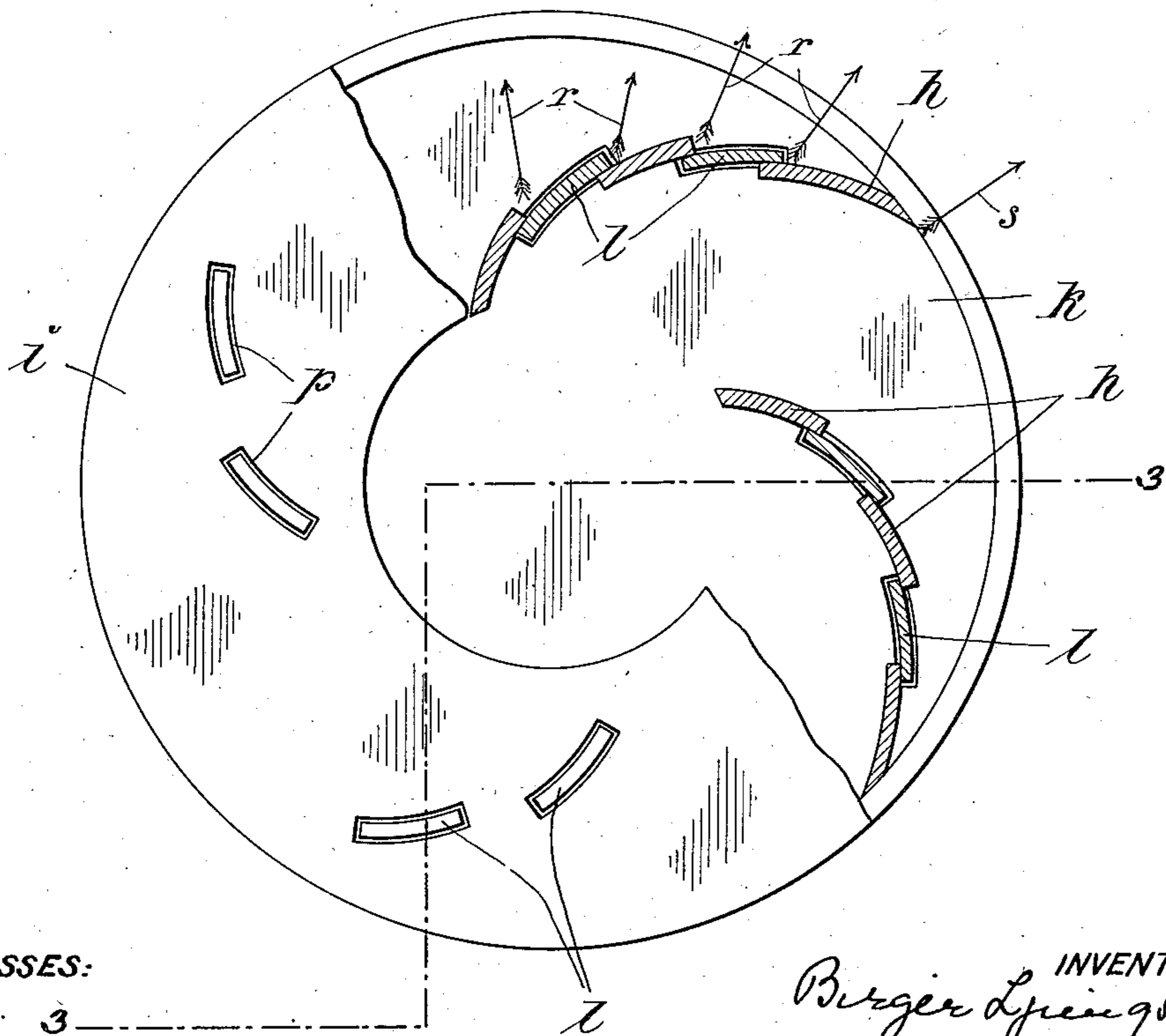
B. LJUNGSTRÖM.  
CENTRIFUGAL MACHINE.  
APPLICATION FILED JUNE 26, 1906.

4 SHEETS—SHEET 2.

*Fig. 3.*



*Fig. 4.*



WITNESSES:

*M. M. Hamilton*  
*E. E. Wall*

INVENTOR  
*Björger Ljungström*  
BY  
*Handing & Handing*  
ATTORNEYS.

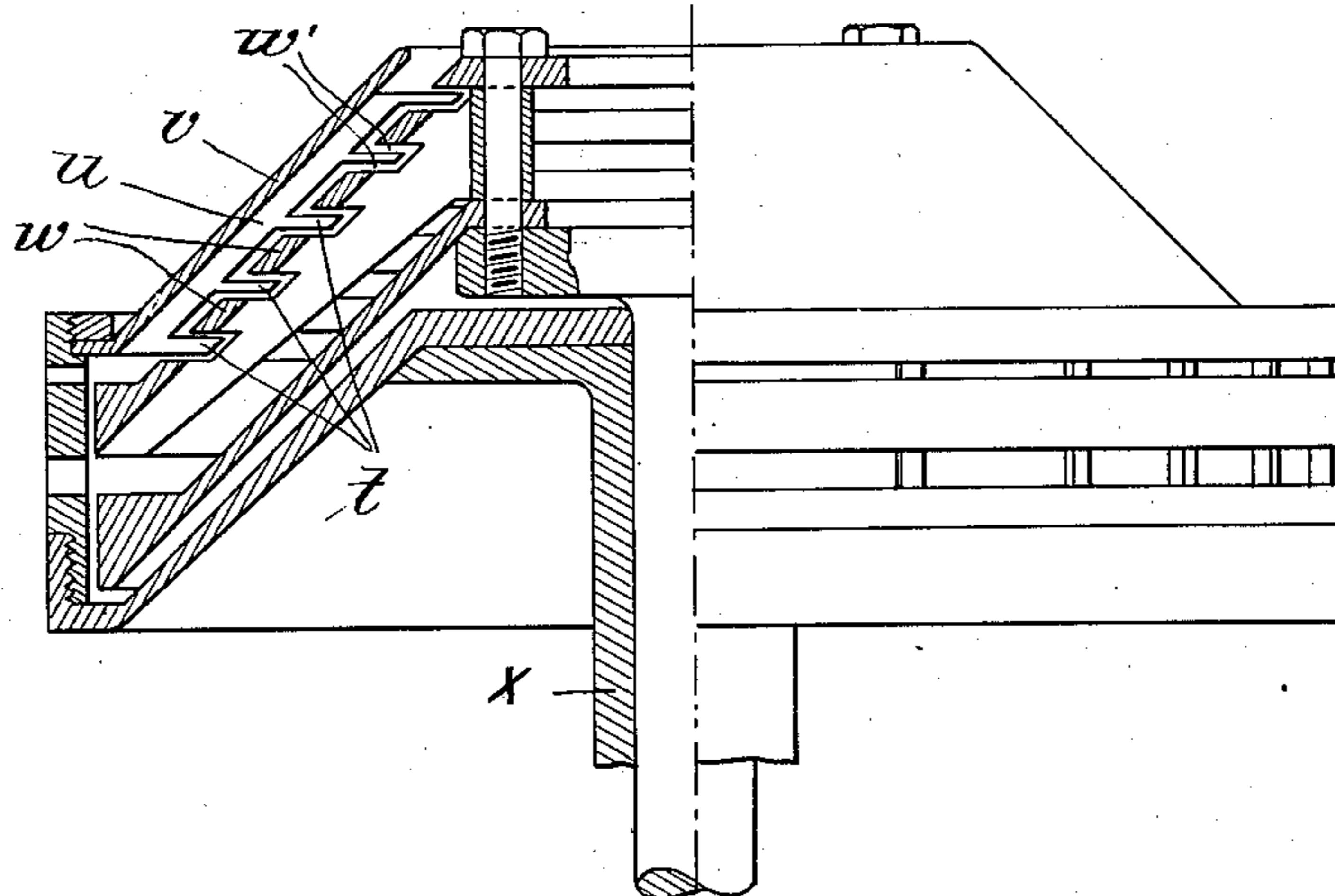
No. 891,271.

PATENTED JUNE 23, 1908.

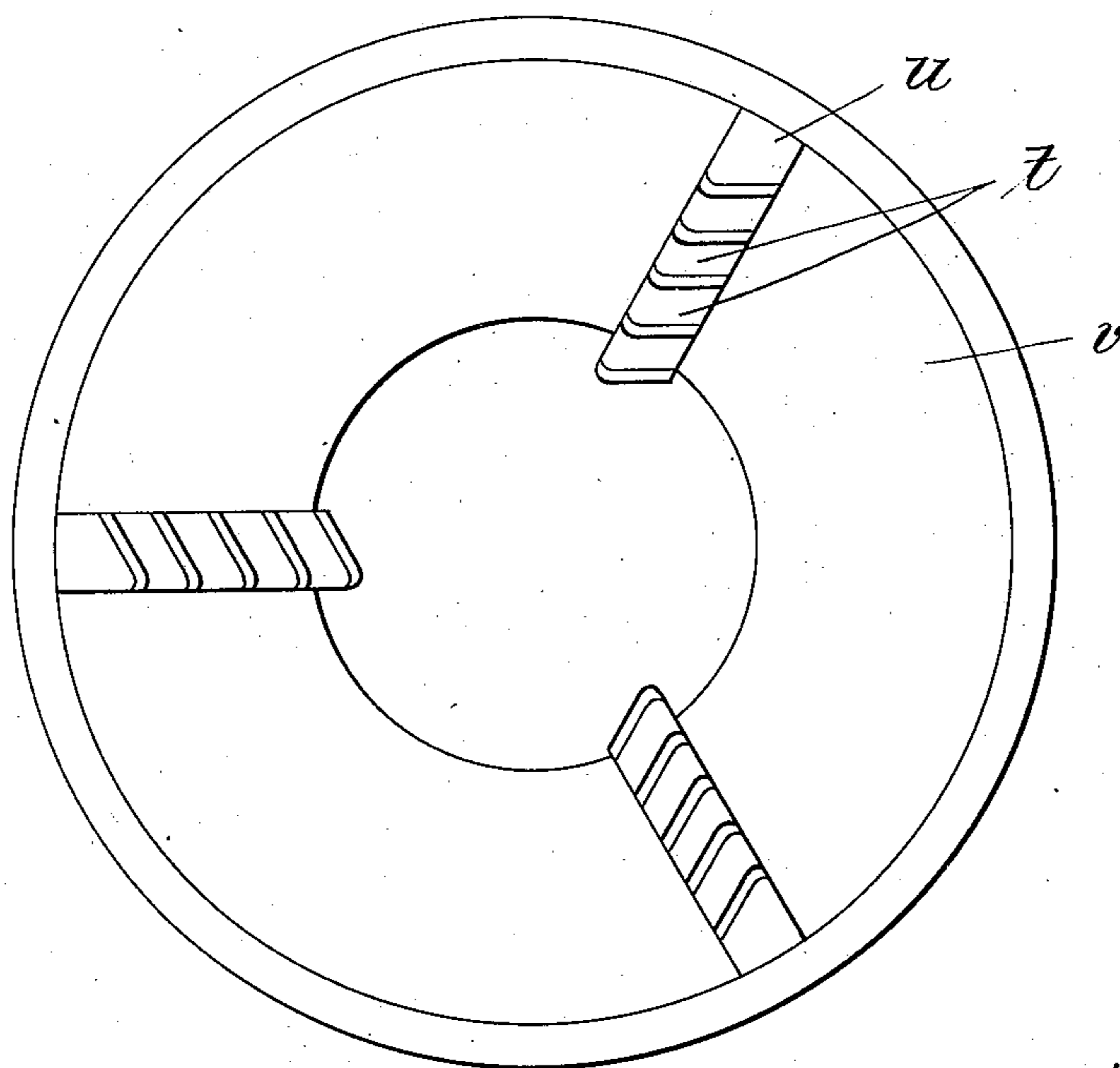
B. LJUNGSTRÖM.  
CENTRIFUGAL MACHINE.  
APPLICATION FILED JUNE 26, 1906.

4 SHEETS—SHEET 3.

*Fig. 5.*



*Fig. 6.*



WITNESSES:

*M. M. Hamilton*  
*E. E. Wall*

INVENTOR

*Björge Ljungström*

BY

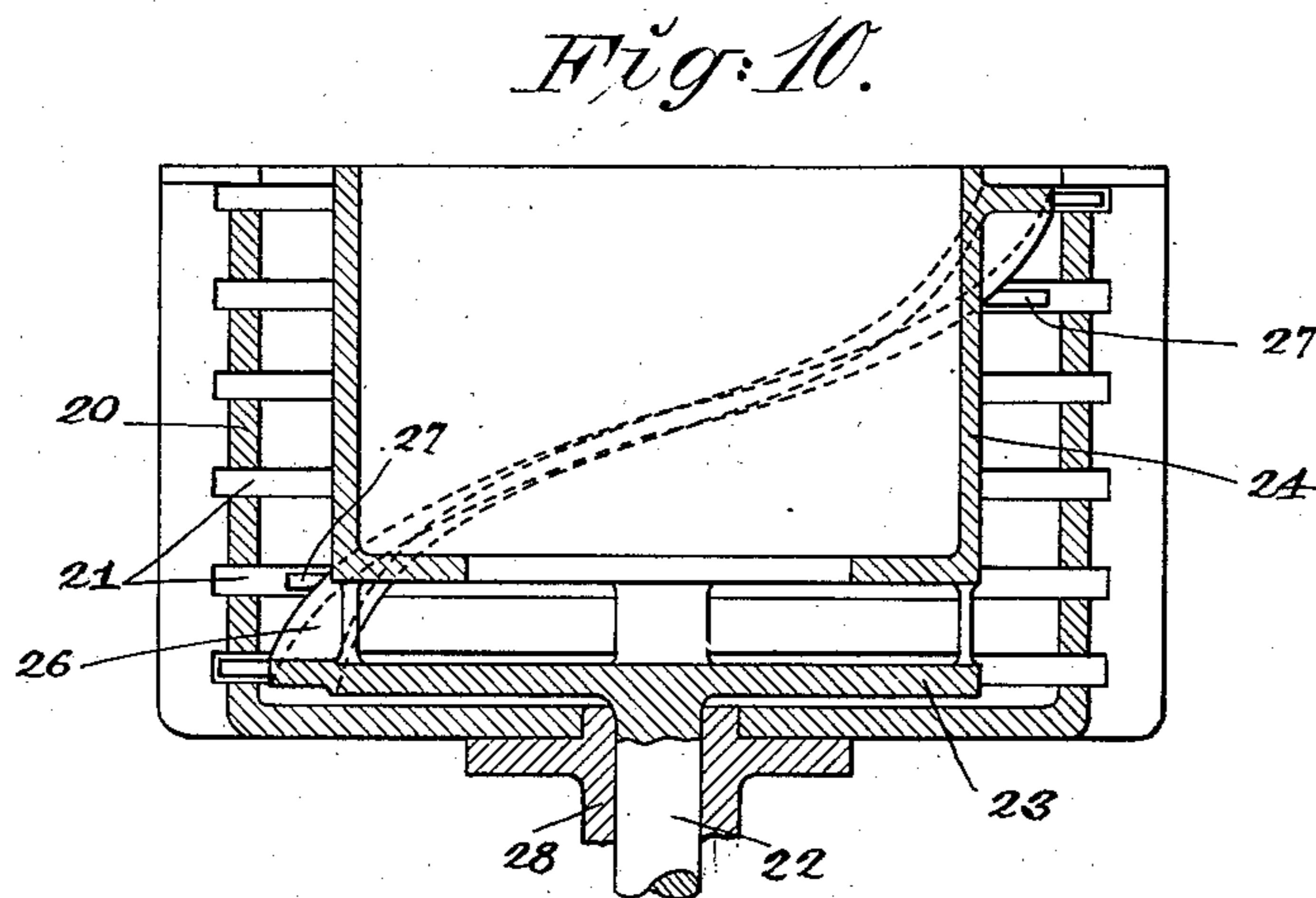
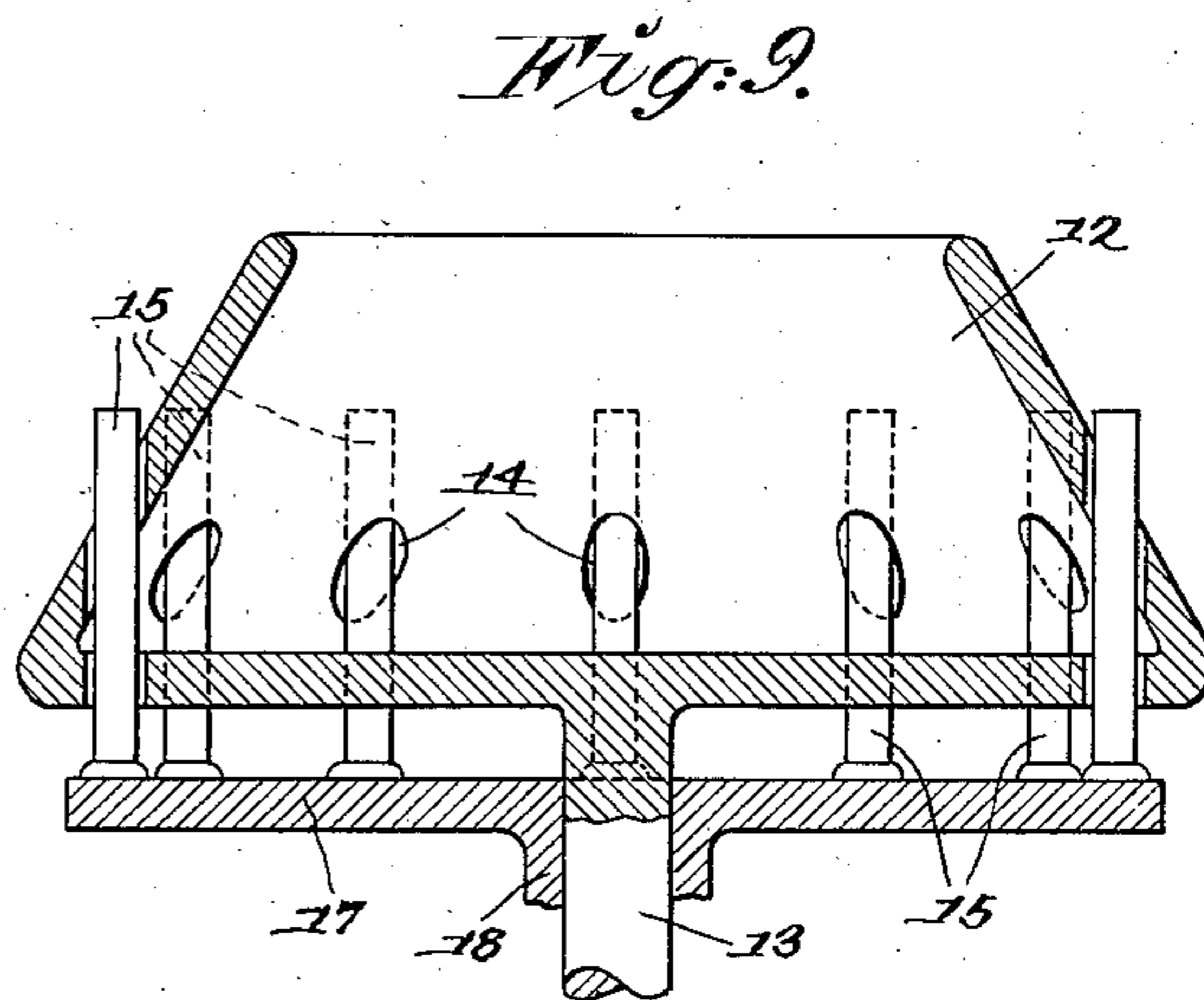
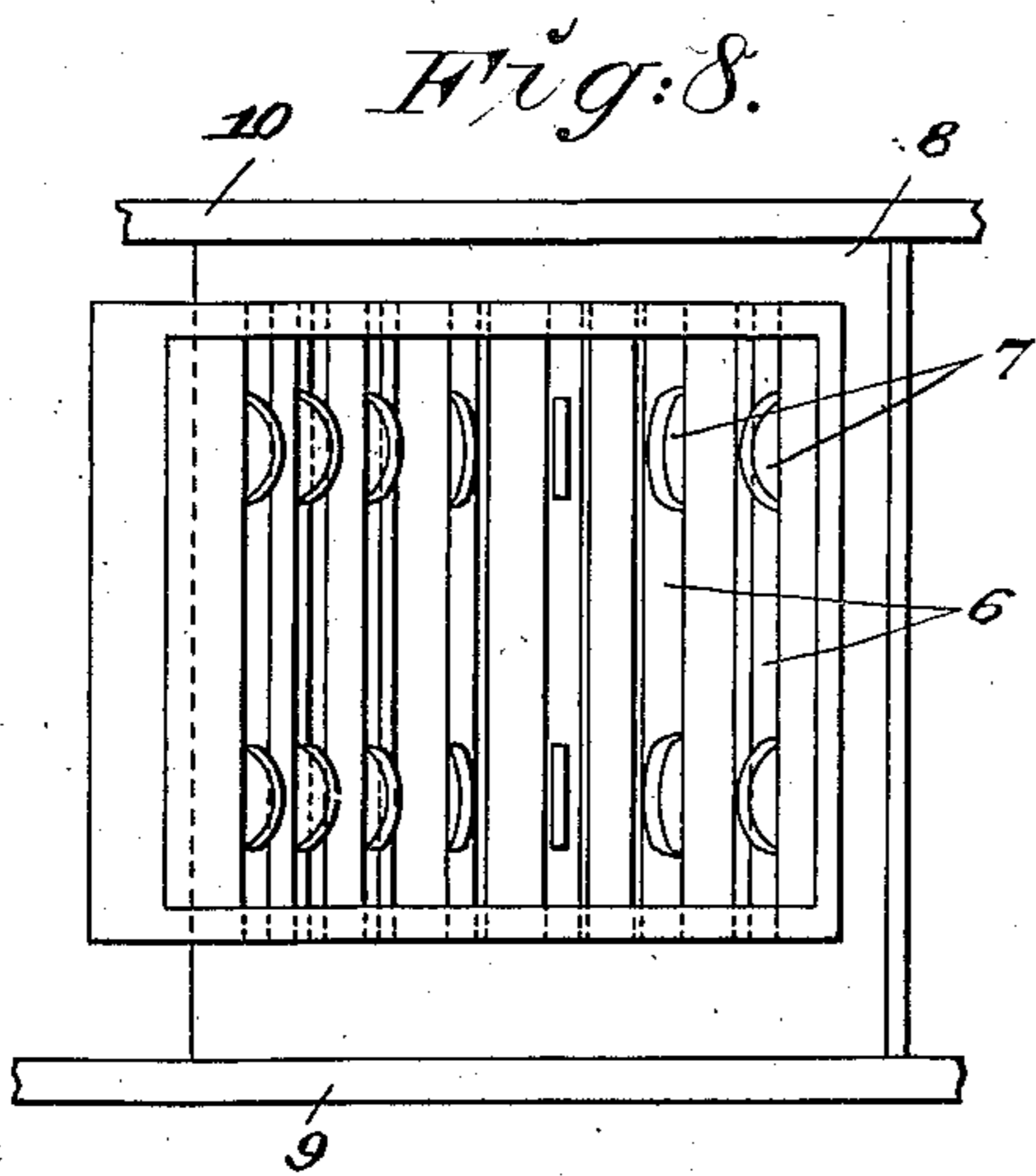
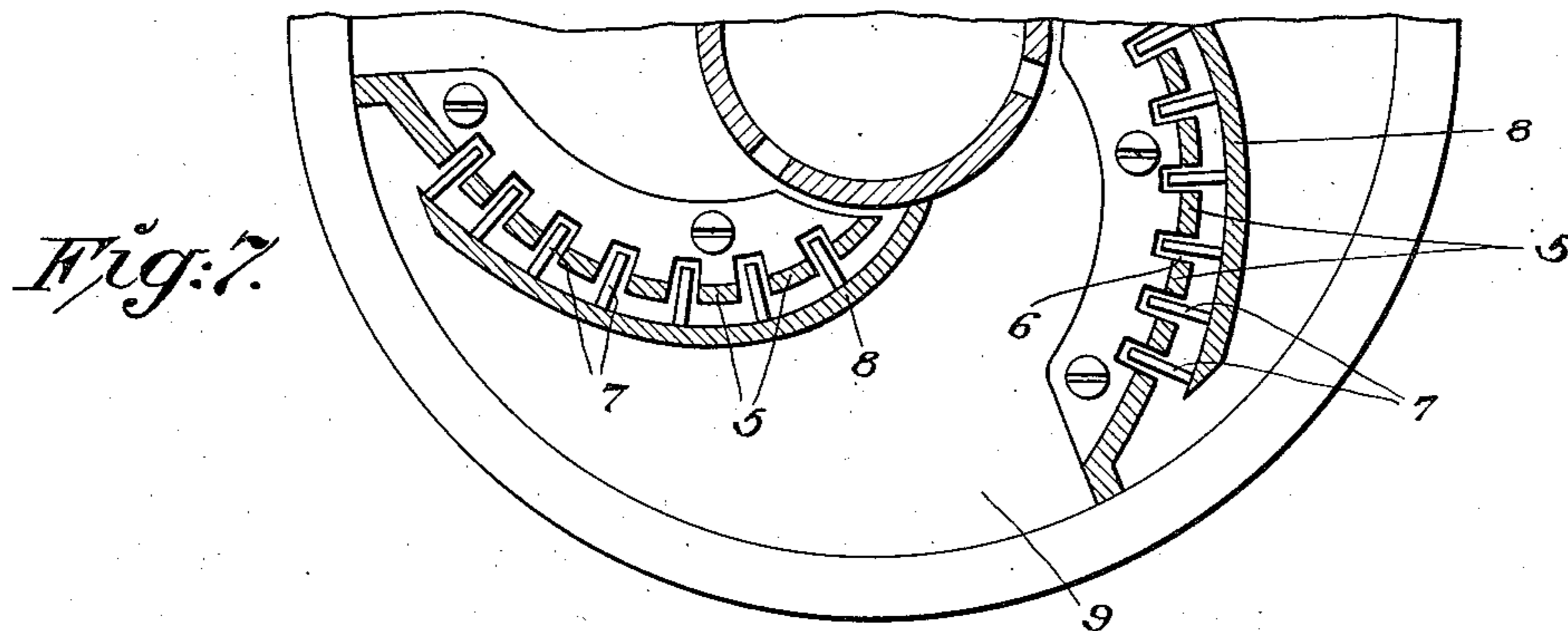
*Haedeling & Harding*  
ATTORNEYS.

No. 891,271.

PATENTED JUNE 23, 1908.

B. LJUNGSTRÖM.  
CENTRIFUGAL MACHINE.  
APPLICATION FILED JUNE 26, 1906.

4 SHEETS—SHEET 4.



WITNESSES:

*M. M. Hamilton*  
*E. E. Hall*

INVENTOR

*Berger Ljungström*

BY

*Harold H. Haring*  
ATTORNEYS.

# UNITED STATES PATENT OFFICE.

BIRGER LJUNGSTRÖM, OF STOCKHOLM, SWEDEN, ASSIGNOR TO AKTIEBOLAGET SEPARATOR, OF STOCKHOLM, SWEDEN.

## CENTRIFUGAL MACHINE.

No. 891,271.

Specification of Letters Patent.

Patented June 23, 1908.

Application filed June 26, 1906. Serial No. 323,444.

*To all whom it may concern:*

Be it known that I, BIRGER LJUNGSTRÖM, a subject of the King of Sweden, and residing at 8 Fleminggaten, Stockholm, Sweden, engineer, have invented certain new and useful Improvements in Centrifugal Machines; 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention relates to certain improvements in centrifugal separators, used for drying purposes, such as drying grain, sugar, crystalline salts, and other substances. In centrifugal machines used for drying purposes, outlets are provided for draining the liquid from the solid. After these machines have been used for a short while, it has been found that they will not work in a satisfactory manner since the outlets become choked with the solids, so that the liquids cannot pass away. The object of my present invention is to avoid these inconveniences.

Generally speaking, I accomplish the result by providing devices which are movable in said outlets to drain the liquid from the solids. Said movable device may have either a reciprocating or a rotating motion, whereby, so as to speak, movable outlets are formed, or they may be moved into and out of the outlets, or certain parts thereof. In the former case, the outlet is formed between the fixed and movable part of the apparatus, which will prevent solids from collecting in said outlets and in the latter case the outlets will be cleared by means of a kind of scraper.

The invention is shown in the annexed drawings in the several forms of construction.

Figures 1 and 2 show an embodiment of my invention, in which Fig. 1 is a partial section on line 1—1. Fig. 2 is a plan view. Figs. 3 and 4 show another embodiment of my invention, in which Fig. 3 is an elevation, partially in section, on line 3—3, Fig. 4. Fig. 4 is a plan view, partially in section, on line 4—4, Fig. 3. Figs. 5 and 6 show another embodiment of my invention, in which Fig. 5 is an elevation, partially in section, and Fig. 6 is an inverted plan view of scrapers and

device to which they are attached. Figs. 7 and 8 show another embodiment of my invention, in which Fig. 7 is a partial cross section through the machine, and Fig. 8 is an elevation of scraper plate and attached scrapers. Fig. 9 is another embodiment of my invention, shown in partial section. Fig. 10 is another embodiment of my invention, shown in partial section.

In Figs. 1 and 2, *a* are a series of concentric rings, connected together by flanges *y*. *c* are concentric rings distributed in the spaces between the rings *a*, said rings *c* being connected together by flanges *d*. The liquid outlets are formed by the spaces *b* between the rings *a*. The rings *a* are mounted upon, or connected to, a hollow shaft *g*. Through this hollow shaft *g* projects the shaft *f*, upon which is mounted, or to which is connected, the rings *c*. During the operation of the machines, the two shafts *f* and *g* are rotated at different speeds, so that the rings *a* and *c* will move relatively to each other. When the material from which the liquid is to be removed is fed in through the upper opening, it will slide along the inclined wall, formed by the rings. The liquid passes away through the spaces or outlets *b*, while the solids slide down to the bottom of the machine and from whence they pass through suitable openings, not shown. If the solids should enter the outlets *b*, they would soon pass to the exterior of the machine, as they are compelled to alter their position on account of the relative motion of the rings.

In the embodiment of my invention shown in Figs. 3 and 4, the same principle is illustrated as in Figs. 1 and 2, but in this case curved plates are used. *h* are several parts of a compound curved plate, which parts are placed at some distance from each other and secured to an upper plate *i* and a lower plate *k*. In the spaces between the parts *h* are arranged other curved plates *l*. The plates *l* are secured to a plate *m*, connected to a central hollow shaft *n* surrounding a solid shaft *o* to the top of which the plate *k* carrying the parts *h* is secured. The plates *i* and *k* are provided with holes *p* for the plates *l*. When the machine is in operation, the two shafts *n* and *o* are rotated at the same rate of speed, but during said rotation are relatively reciprocated in axial direction, by means not

shown, whereby so to say "movable outlets" for the liquid are formed between the parts *h* and *l*. The liquid escapes in the direction of the arrows *r* and the solids in the direction indicated by the arrow *s*.

In Figs. 5 and 6 another form of embodiment of my invention is shown. This construction is somewhat similar to that shown in Figs. 1 and 2. The rings *w* are separated from one another by spaces *w'*, which, however, in this case are very narrow. Instead of rings, moving in said outlets, scrapers *t* are arranged therein, which, preferably, have their edges inclined, as shown in Fig. 6. The scrapers are connected together and secured to the plate *v* by means of ribs or flanges *u*, said plate being connected to the shaft *x*. The other shaft *z* is connected to the rings *w*. The solids which collect in the outlets *w'* will soon be removed by the scrapers *t*, which move in said outlets, owing to the shafts *x* and *z* rotating at different speeds.

In Fig. 6, the plate *v*, with the scrapers *t*, is shown from below.

The construction shown in Figs. 7 and 8 differs from that shown in Figs. 5 and 6 in the use of curved plates 5. The latter is provided with slots 6 in which are arranged scrapers 7. The said scrapers are secured to a plate 8, and the plates 5 may be secured to a lower disk 9 and an upper disk 10, which are connected to one shaft, while the disk 8 may be connected to another and concentric shaft, the shafts being revolved at same rates of speed and given a relative reciprocating motion in an axial direction, as stated with respect to Figs. 3 and 4.

In the construction shown in Fig. 9, 12 designates a conical drum, secured to the shaft 13. Said drum is provided with apertures 14 in which are located pins 15, secured to a plate 17, mounted on a hollow shaft 18, surrounding the shaft 13 carrying the drum. The shafts 13 and 18 rotate at the same speed, but have a relative reciprocating motion in an axial direction by mechanism not shown. If the pins 15 only move in the apertures 14, a form of "movable outlet" is formed, but if, on the other hand, they move completely into and out of said apertures, in which case the latter must be of very small dimensions, in order to prevent the solids escaping directly therefrom, the said pins will act as scrapers and force out the solids which have collected in said apertures 14.

In Fig. 10, another embodiment of my invention is shown. In this case, the material is carried along the inner wall of a series of

rings, forming a cylindrical drum 20, by means of a screw.

20 designates the drum and 21 the annular openings between the rings of the drum.

28 is the hollow drum shaft and 22 a solid shaft therein, carrying a plate 23, supporting an inner drum 24. The latter is provided with one or more helical blades 26, inclined scrapers or the like, on which are arranged small scrapers 27 projecting into the aforesaid openings 21. The two shafts 28 and 22 rotate at different speeds and the material to be treated is fed through an opening in the bottom of the drum 24 and then flows over plate 23 towards the inner wall of the outer drum 20. While being worked along said wall by the helical blades, the separating process takes place, and the liquid escapes through the openings 21. The solids, which collect in said openings, will be forced out therefrom by means of the scrapers 27.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. The combination, with centrifugal machines for drying purposes, having outlets for draining the liquid from the solids, of devices movable in said outlets to clear them from solids.

2. The combination, with centrifugal machines for drying purposes, having outlets for draining the liquid from the solids, of devices within said outlets and movable relative to said outlets to clear said outlets from solids.

3. The combination, with centrifugal machines for drying purposes, having annular outlets for draining the liquid from the solids, of devices movable in said outlets to clear them from solids.

4. The combination, with centrifugal machines for drying purposes, having annular outlets for draining the liquid from the solids, of inclined devices movable in said outlets to clear them from solids.

5. The combination, with centrifugal machines for drying purposes, provided with outlets for draining the liquid from the solids, of a conveying device to carry the material through the machine, and scrapers secured to said conveying device and movable in said outlets.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

BIRGER LJUNGSTRÖM.

Witnesses:

HJ. ZETTERSTRÖM,  
HARRY ALBIN.