(No Model.)

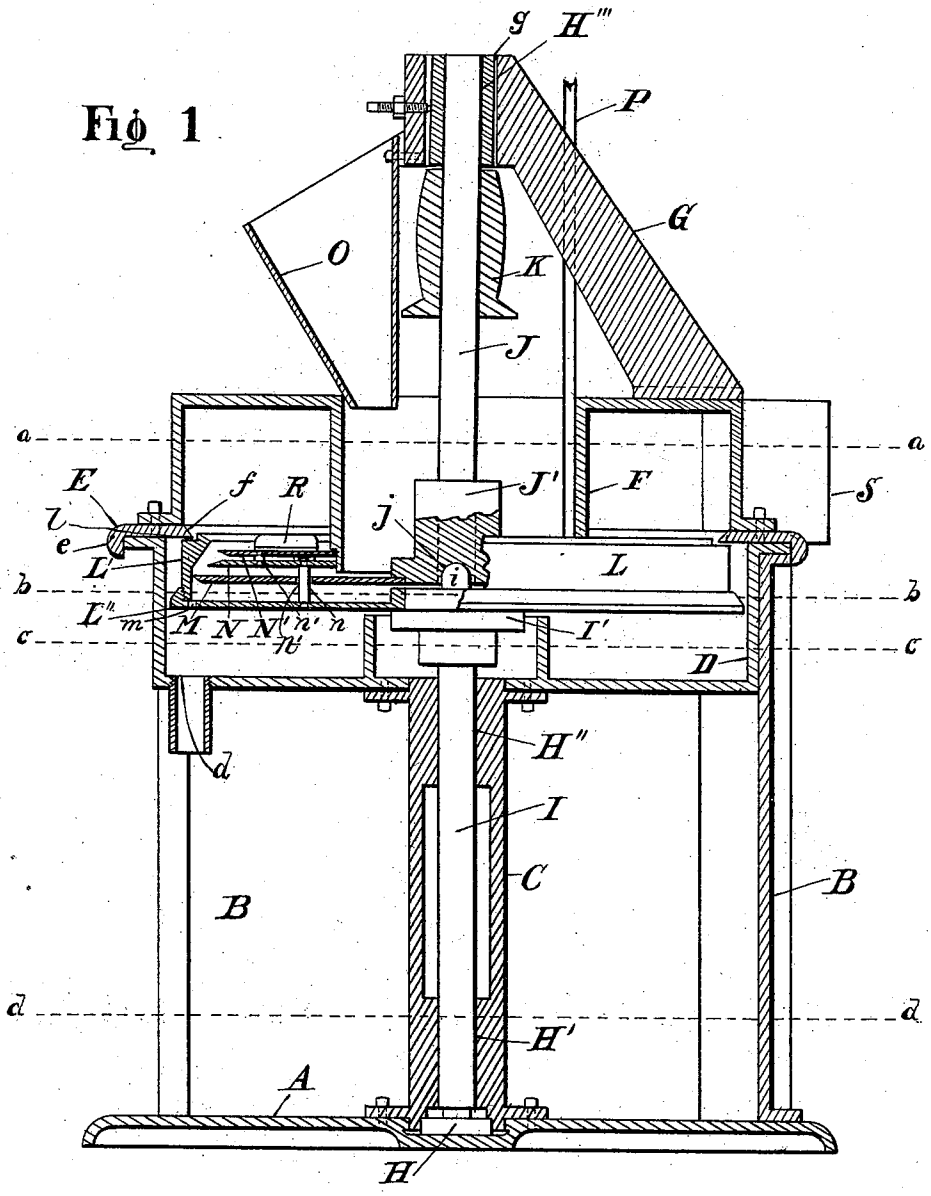
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J. NAYLOR, Jr.

CENTRIFUGAL MACHINE.

No. 599,725. Patented Mar. 1, 1898.

Fig. 1.



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Fig. 2

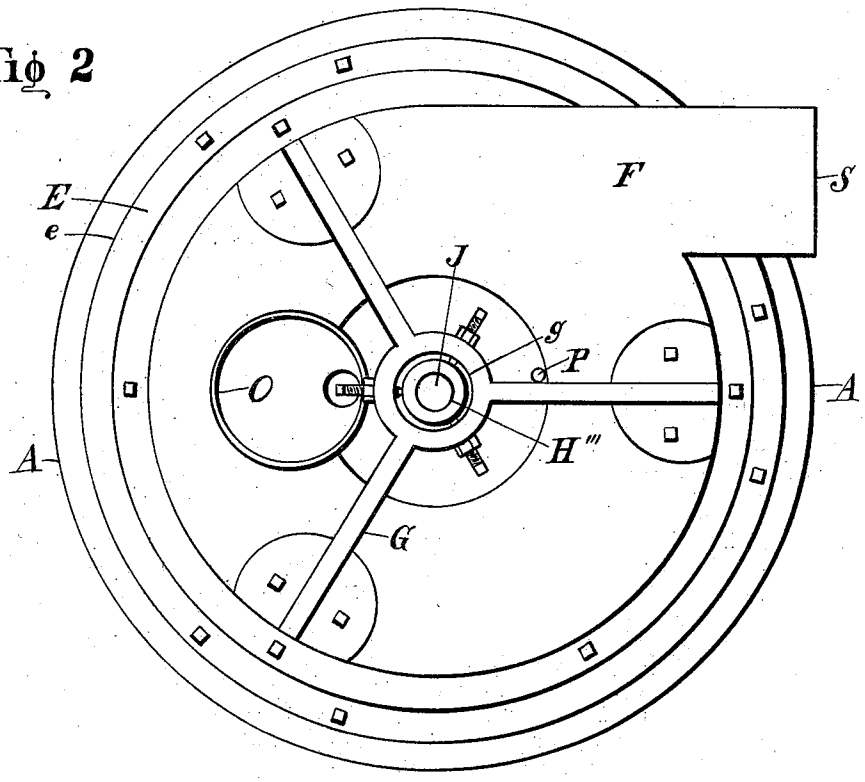
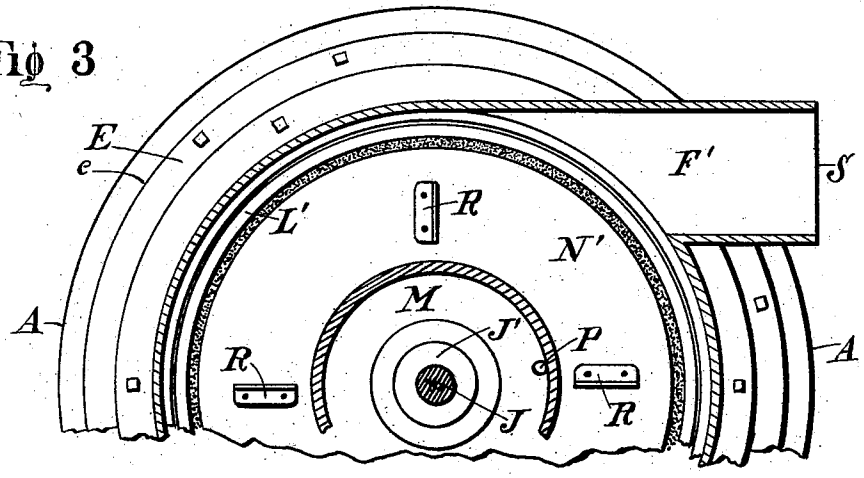


Fig. 3



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Fig 4

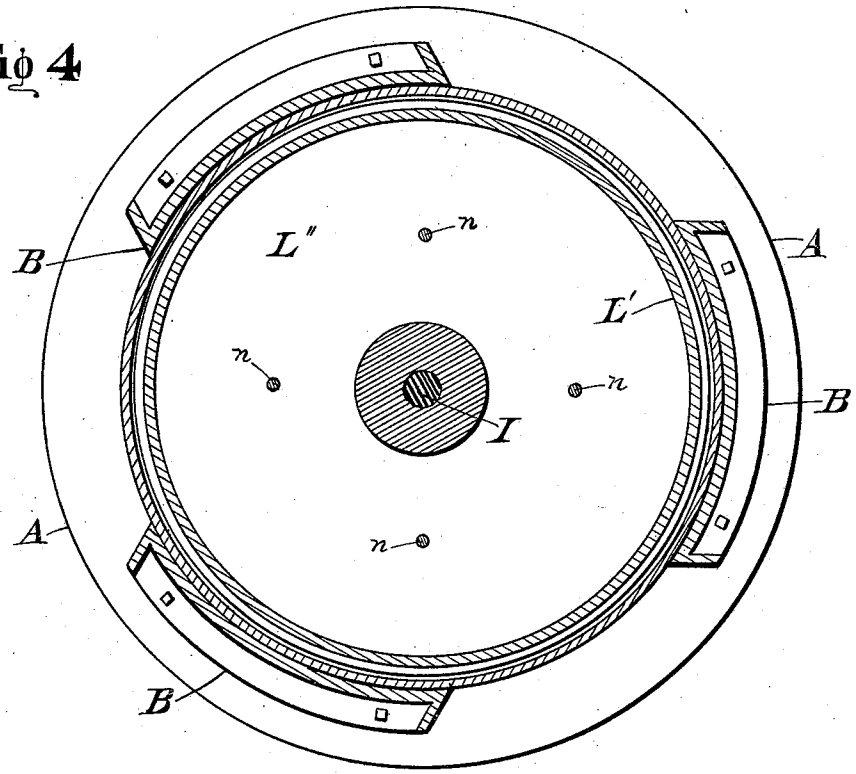
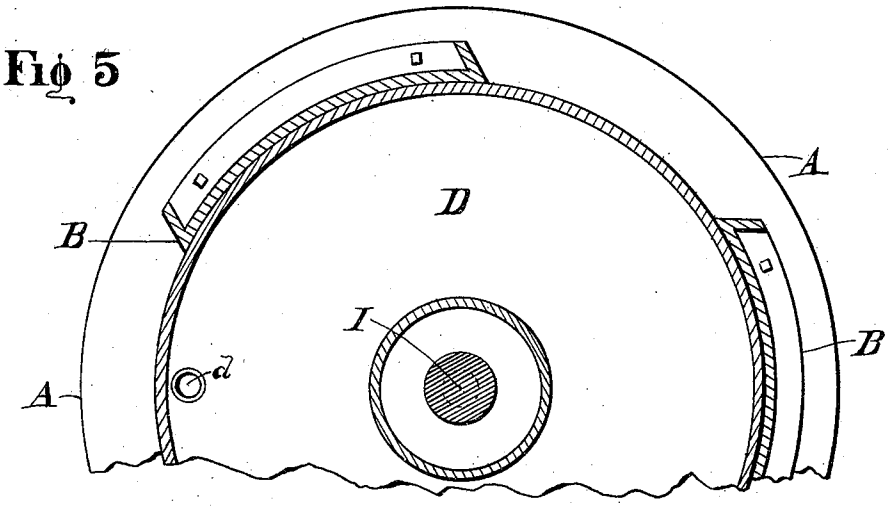


Fig 5



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Fig 6

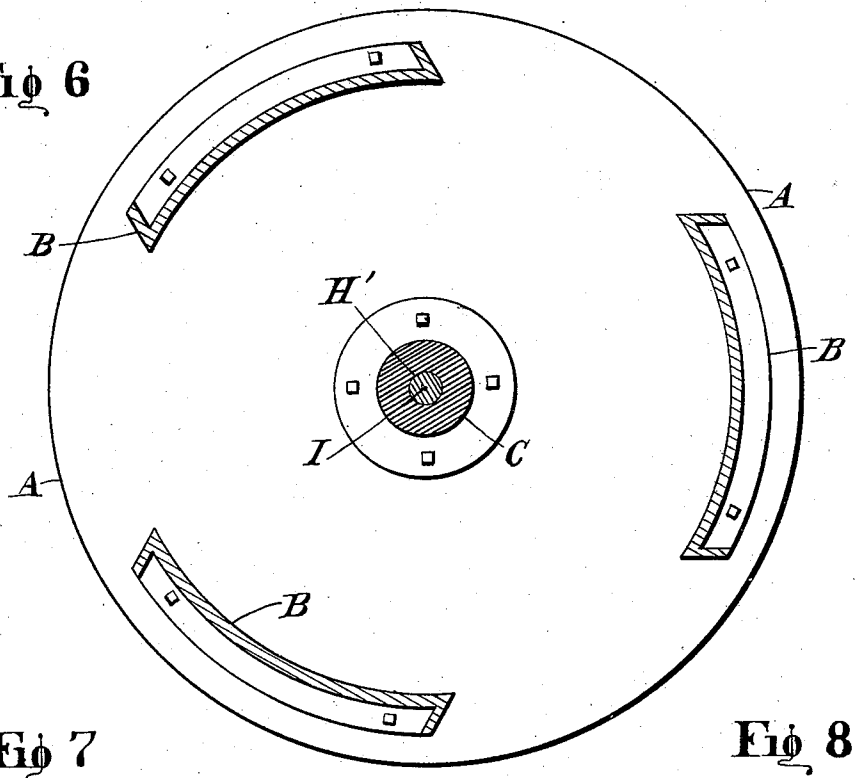


Fig 7

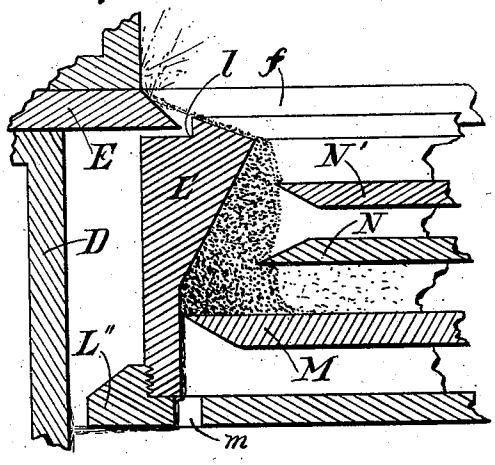
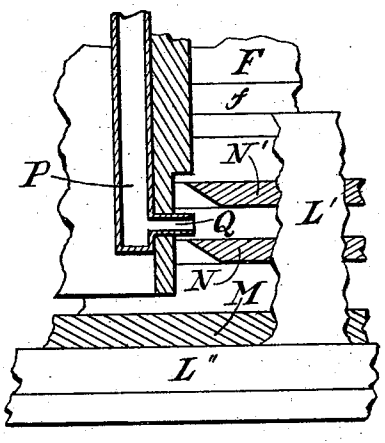


Fig 8



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UNITED STATES PATENT OFFICE.

JAMES NAYLOR, JR., OF BOSTON, MASSACHUSETTS.

CENTRIFUGAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 599,725, dated March 1, 1898.

Application filed September 27, 1895. Serial No. 563,859. (No model.)

To all whom it may concern:

Be it known that I, JAMES NAYLOR, Jr., a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Continuous Centrifugal Separators, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to a machine for the continuous separation by centrifugal force of a liquid from solid matter and the removal of the solid matter continuously therefrom, it being especially adapted for the separation of sugar crystals from the syrup containing and forming them, as is well known in the art of sugar-refining.

It consists of a bowl and a disk each separately mounted on separate arbors, the arbors being set out of alinement and driven in unison, so that the planes of rotation of said bowl and disk are oblique to each other and operated in such a manner that an enforced discharge of solid matter from the bowl is effected with freedom for the liquid to escape in an opposite direction.

It also consists of the depending parts and their construction, so that their operation is full and complete, as will be hereinafter fully described, and specifically set forth in the claims.

In the drawings, Figure 1 is a sectional elevation; Fig. 2, a plan; Fig. 3, a horizontal section on line *a a* of Fig. 1; Fig. 4, a like section on line *b b*, and Fig. 5 that on line *c c*, Figs. 6 and 7 being enlarged detail views.

The frame of the machine is made of several parts, some of which perform very important functions in the operation of the machine, and for this reason its construction is described in detail. It is, however, distinctly understood that the parts as shown and described separately may be cast in one piece or the general design may be modified without in any way departing from the construction and its functions.

A is a circular base-plate, to which are secured the segmental posts B and the hollow center post C.

D is an annular basin provided with an outlet *d*, said basin being firmly secured to the said hollow center post and the segmental posts. To the basin D there is secured an annular ring E, having a flange *e* around its periphery and a beveled inner edge, as shown at *f*. The same means that fasten the basin and ring together also take hold of the segmental posts, so that all are secured together.

F is a blast-case having a central inlet-opening and a tangential outlet at F′, which will be further described in the operation. The said case is secured close onto the ring E, and onto the upper surface of the case the tripod G is firmly bolted, the said tripod having an opening *g* at its apex.

The foregoing constitutes the actual framework of the machine.

H is a hardened-steel step inserted to a recess of the bed-plate.

H′ is the lower bearing-box, H″ the intermediate bearing-box, and H‴ the upper bearing-box. The two former are within the center post C and the latter within the opening *g* of the tripod G in such a manner that it is out of alinement with the former. All these bearing-boxes are to be considered as unyielding to the frame of the machine and in contradistinction to the yielding bearing-box, as is generally used in this class of machines.

I is the lower arbor, upon which is secured, so as to be a part of it, a rabbeted flange I′, or said flange may be made solid with the arbor. The said arbor has a semispherical head *i* and is mounted upon the step H in the bearing-boxes H′ H″.

J is the upper arbor, with a like rabbeted flange J′ and a semispherical cavity or seat *j* for the said semispherical head *i*. This arbor rests by gravity on the arbor I and is held in place by the semispherical head and recess of the arbors and the upper bearing-box H‴. It is not essential that the head *i* should be semispherical. All that is actually required is means for holding the arbors together with a slight freedom of oscillation.

The intermediate bearing-box H″ is in perfect alinement with the lower, both being on the same arbor; but in relation to the upper arbor and the upper bearing-box H‴ it is out of alinement. The drawings show this feature exaggerated, so as to be clear.

Secured to the upper arbor is the pulley K, by which motion is communicated to the

lower arbor, so that both are driven in unison by means which will be hereinafter described.

L is the bowl, which is made of an inwardly-flaring ring L′ and a disk L″, united together, as shown, or by any other devised means, and provided with a series of openings or perforations at its largest internal diameter. The ring L′ is rabbeted at *l* (see Fig. 7) around its upper periphery and is arranged to run in close proximity to the ring E of the frame.

M is the disk, which is secured to the flange J in any substantial manner. Its periphery is fitted to the largest inner diameter of the bowl and formed to an annular pointed edge with all the bevel on the under side.

The bowl L is mounted to the lower arbor and the disk M to the upper, so that the said bowl and disk revolve in different planes or are oblique to each other in their rotation.

N is a disk secured to the disk L″ of the bowl by the studs *n*, having its periphery at a distance inward from the ring L′ of the bowl and with its annular beveled edge having the bevel thereof on its upper side. Another disk N′, similar to the former, except that the annular bevel is on its under side, is carried also by the studs *n* from the bowl and the studs *n′* from the disk N. (See Fig. 1.) The studs *n* pass freely through openings provided in the disk M, which constitutes the means whereby the upper and lower arbors are so connected as to be driven in unison.

O is a feed-hopper supported to the tripod G and frame, having its lower discharge terminating at or into the central opening of the blast-case. The wall of this central opening extends downward within and beyond the disks N and N′ and nearly to the upper surface of the disk M, where and by which an annular opening is formed, through which the feed passes to the bowl and air to the blast-case.

P is a pipe for the introduction of a treating agent to the sugar crystals before their discharge from the bowl—as, for instance, a jet of hot water—to thoroughly wash or bleach the crystals and to impart heat thereto, so as to assist in driving off moisture. This pipe terminates at the nozzle Q, where the hot jet is injected between the disks N and N′.

R are wings secured to the upper surface of the disk N′, which serve to give an adequate blast within the case F to carry off the crystals after discharge from the bowl.

It may now be observed that the plane of revolution of the bowl L will differ from that of the disk M within the bowl and that both are revolving in unison, with an actual difference in the respective planes which predetermines the maximum quantity of the solid matter discharged.

The operation is as follows: The boiled syrup forming and containing the crystals is run from a mixer or agitator to the hopper O, passing to and through the center opening of the blast-case and onto the upper surface of the disk M, the contact of which by the motion is thrown outward between the disks M and N and is deposited in contact with and is held by the ring L′ of the bowl, where a certain accumulation of crystals is continually going on and at the same time a certain quantity is continually discharged, as will be further explained. Meanwhile the syrup is thrown by centrifugal force through the interstices of the crystals and finds free exit therefrom through the extremely-fine opening between the periphery of the disk M and the bowl, which opening is continually on the move or in a state of constant disturbance by which it is kept free and clear to pass the syrup, yet at the same time acts as a barrier to the crystals. The syrup then passes freely from the bowl through the series of openings in its periphery to the annular basin and is conducted therefrom at the outlet *d*. On the accumulation of crystals above the disk M and against the ring L′ of the bowl every revolution forces the mass of crystals upward a distance equal to the difference in their planes of rotation of said disk and ring, and in every revolution there is also a corresponding slack or open space created between said disk and the mass of crystals which is instantly taken up by incoming crystals. There is also a continual approaching and receding movement of the disks M and N, which has the effect of slightly disturbing any accumulation of crystals between them, thus preventing any lodgment or accumulation which would cause the machine to run out of balance. It will thus be seen that there is a perfect movement upward of all the crystals and that every individual crystal has precisely the same positive movement as its neighbor and that all pass through the bowl in a regular order as a mass.

The amount or limit of accumulation which has been determined by test is that described by the peripheries of the disks N and N′ and the overflow at the upper edge of the ring L, (see Fig. 7,) and when this amount is contained any added thereto will cause a corresponding discharge. A continuous feed thus causes a continuous discharge of crystals over the upper edge of the bowl, being thrown by centrifugal force against the beveled surface *f* and deflected upward into the blast-case, where they are caught by the blast given by the wings R and blown out at the tangential discharge clear of the machine at S.

A jet of hot water or other cleansing agent is injected between the disks N and N′, which has the effect to whiten the crystals during their travel upward in the bowl, the hot water from the jet finding its exit from the bowl along with the syrup, which is continually being thrown through the interstices of the mass to the annular opening between the periphery of the disk M and the bowl, through which it passes to the openings in the periphery of the bowl and to the basin, from which it is conducted clear of the machine.

Having thus described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. In a centrifugal machine the combination with a bowl and a disk each separately mounted in unyielding bearings, said bearings set out of alinement in such manner that the inner periphery of said bowl is in near proximity to the outer periphery of said disk; of means for inflow thereto and for carrying off the liquid constituent.

2. In a centrifugal machine the combination with a bowl mounted upon one end of its arbor, a disk mounted upon one end of its arbor and supported by and within the said bowl; of unyielding bearings set out of alinement to sustain the said bowl and disk in planes of rotation oblique to each other.

3. In a centrifugal machine the bowl composed of an imperforate ring and a perforate disk mounted in rigid bearings and provided with means for inflow; in combination with an obliquely-mounted disk within said bowl to effect the discharge therefrom of the separated parts.

4. In a centrifugal machine the bowl provided with an annular rabbeted edge *l*, holes *m* and means for inflow; of an obliquely-mounted disk within said bowl and means for carrying off the separated and discharged constituents.

5. In a centrifugal machine the combination with the supported rigid bearings H′ H″ in alinement and the bearing H‴ out of alinement, the arbors mounted therein and together supporting the perforate bowl and disk; of means whereby the said bowl is fed and the separated discharges conducted therefrom as herein set forth.

6. In a centrifugal machine the combination with a perforate bowl supporting a disk within, each mounted on separate arbors and set out of alinement; of a basin and case inclosing the said bowl each having an outlet, and an annular interposed ring to divide the inclosed space into two compartments.

7. In a centrifugal machine the combination with a mounted perforate bowl and its contained obliquely-mounted disk; of the studs *n* secured to said bowl and extending freely through openings in said disk as constituting the means whereby the said bowl and disk are held in unison in their rotation.

8. In a centrifugal machine the combination with a mounted perforate bowl and the disks N N′ supported thereto; of the obliquely-mounted disk and means whereby inflow is maintained thereto and the separate discharges conducted from the bowl as herein set forth.

9. In a centrifugal machine the mounted perforate bowl with its contained obliquely-mounted disk and means for inflow thereto; in combination with the annular ring provided with its beveled edge *f* as effecting the parting of the separate discharges as herein set forth.

10. In a centrifugal machine the combination with a perforate bowl and a disk within said bowl, both having independent means of support and rotating in planes oblique to each other; of an annular ring and a case provided with a central inlet and a tangential outlet opening.

11. In a centrifugal machine the combination with a mounted perforate bowl and disks N N′ revolving in a horizontal plane, a separately-mounted disk revolving in an oblique plane; of a nozzle connected to a supply and interposed between the said disks N N′ so that the stream from said nozzle is confined and so carried to the inner periphery and through the perforations.

12. In a centrifugal machine the combination with a horizontally-mounted perforate bowl, an obliquely-mounted disk within said bowl; of an annular ring, and a basin having an outlet below said ring and a case with a tangential and central opening above it.

13. In a centrifugal machine the combination with a bowl mounted to revolve in a horizontal plane and a disk mounted to revolve in an oblique plane; of studs *n* secured to said bowl and passing freely through said disk to effect unity of rotation as herein set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 19th day of September, A. D. 1895.

JAMES NAYLOR, JR.

Witnesses:
FRANK L. NAYLOR,
V. WM. NAYLOR.