6 Sheets—Sheet 1.

G. F. FINCKGRAEFE.

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Fig. 9.

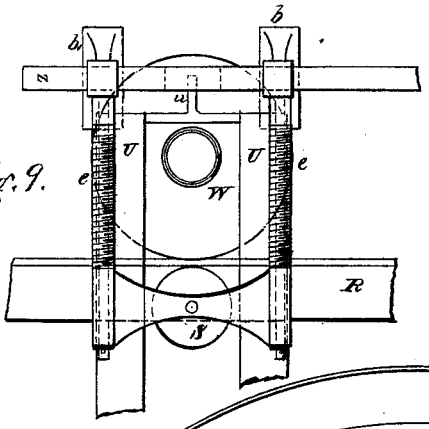


Fig. 10.

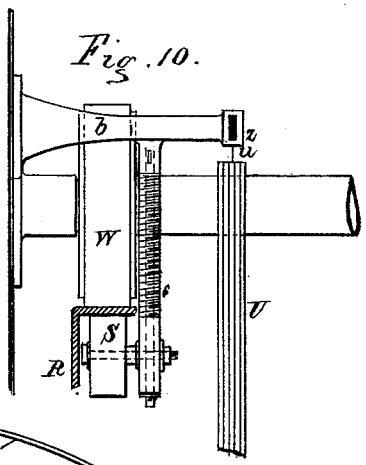
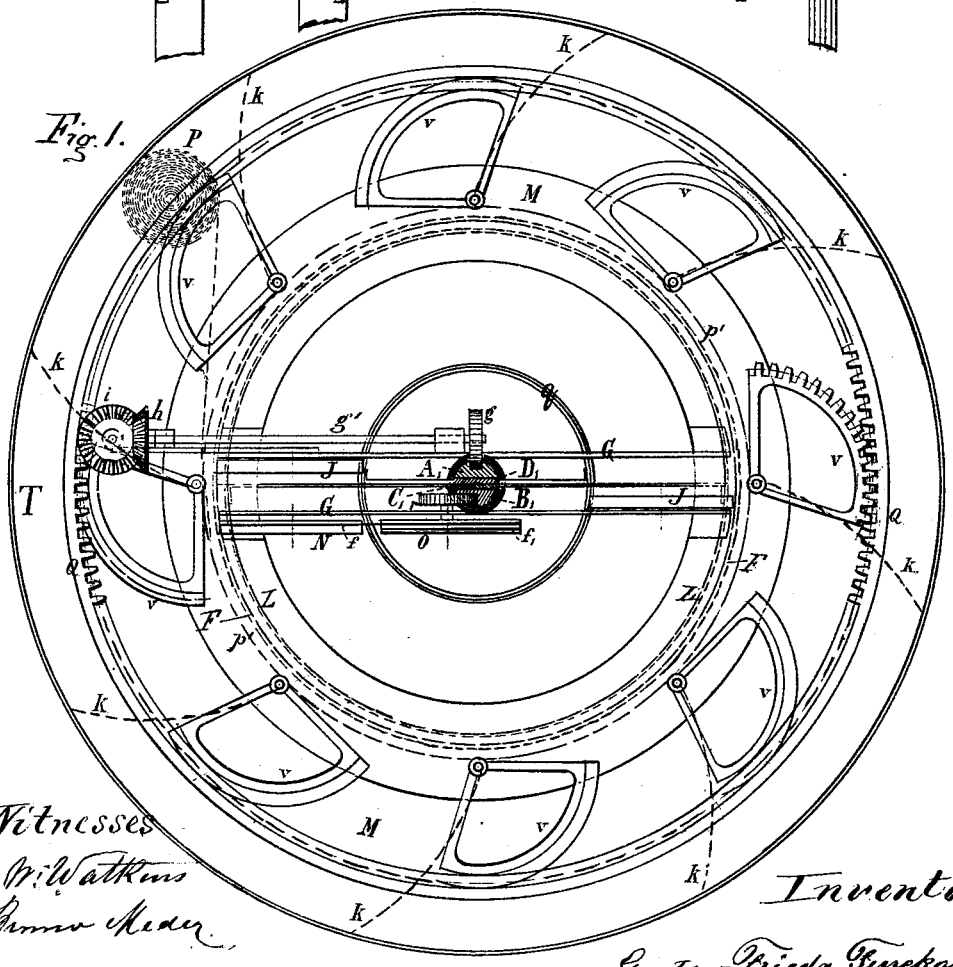


Fig. 1.



Witnesses
J. Wilkins
Benno Reder

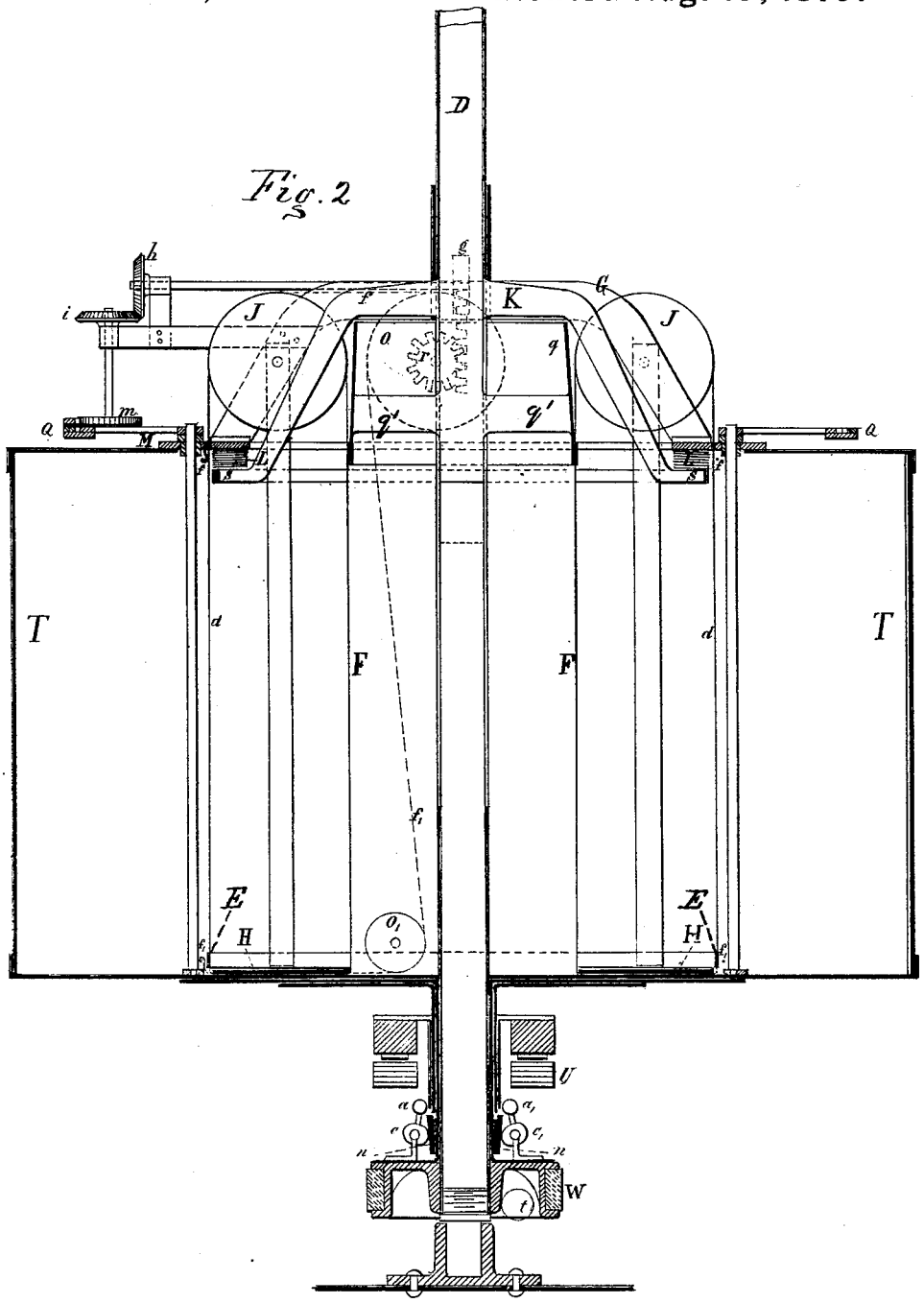
Inventor.
Gustav Friedr. Finckgraefe

G. F. FINCKGRAEFE.

Centrifugal Machine.

No. 218,670. Patented Aug. 19, 1879.

Fig. 2.



Witnesses.
J. W. Watkins.
Brune Meier.

Inventor
Gustav Friedr. Finckgraefe

6 Sheets—Sheet 3.

G. F. FINCKGRAEFE.

Centrifugal Machine.

No. 218,670. **Patented Aug. 19, 1879.**

Fig. 3.

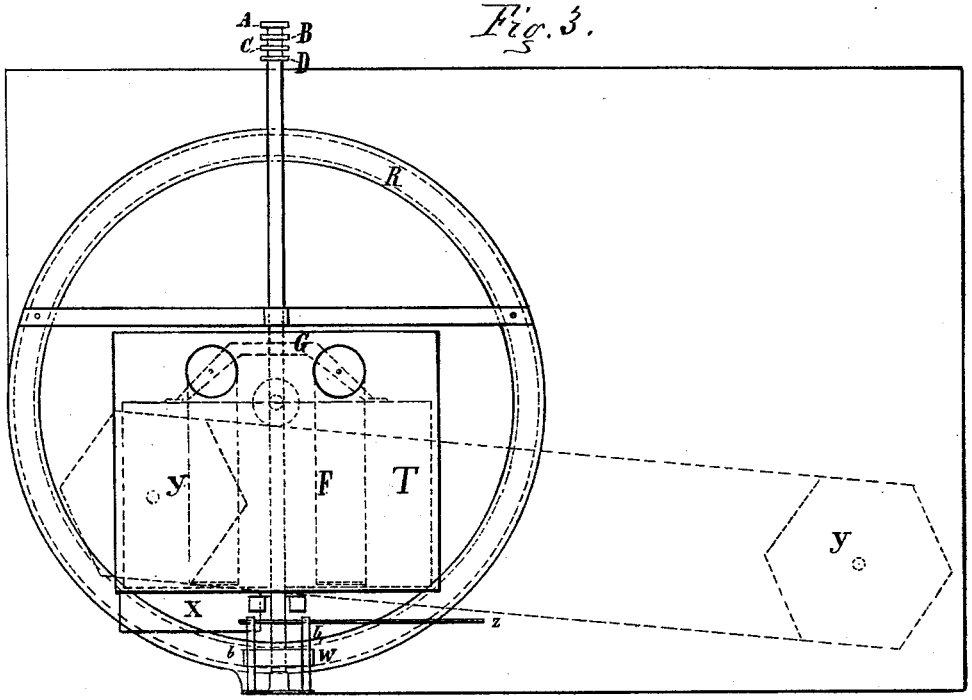
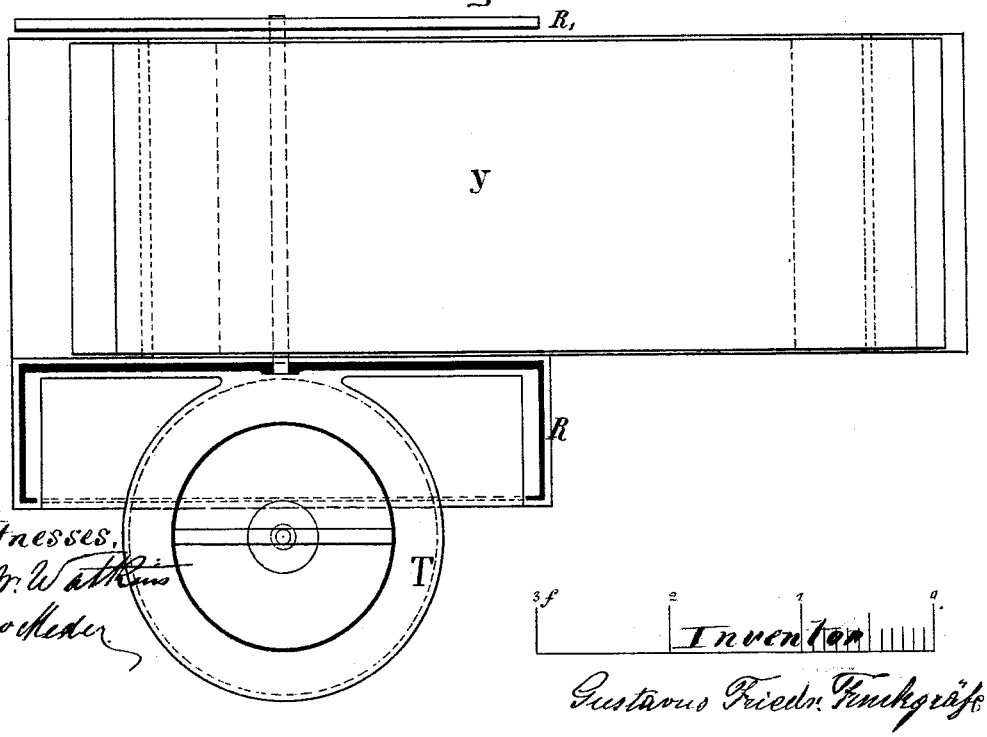


Fig. 4.



Witnesses.
J. W. Watkins
Jamo Meder

Gustavus Friedr. Finckgräfe

6 Sheets—Sheet 4.

G. F. FINCKGRAEFE.

Centrifugal Machine.

No. 218,670. **Patented Aug. 19, 1879.**

Fig. 5.

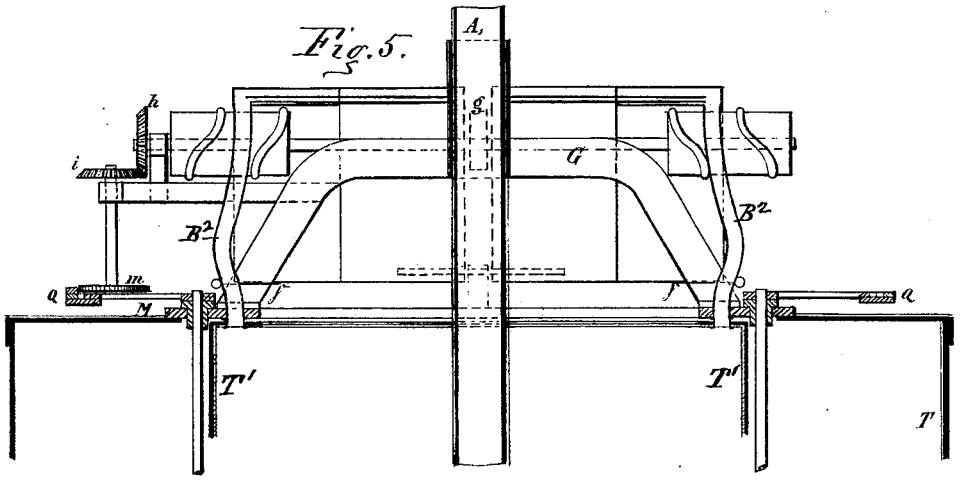
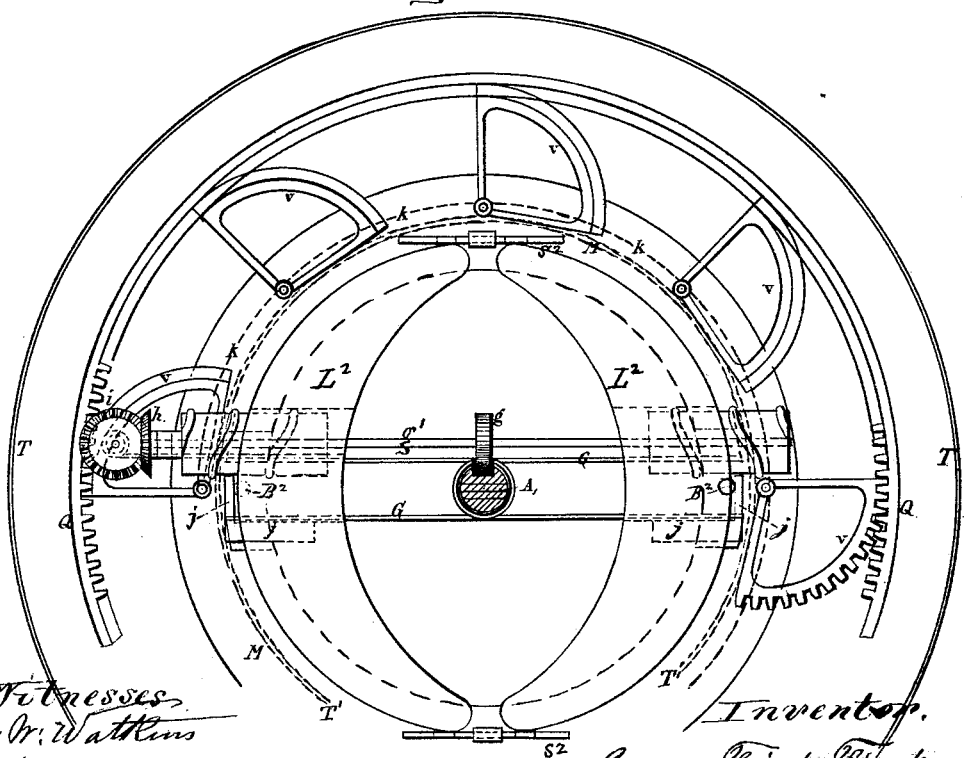


Fig. 6.



Witnesses
J. Br. Watkins
Brune Meder.

Inventor.
Gustav Friedr. Finckgraefe

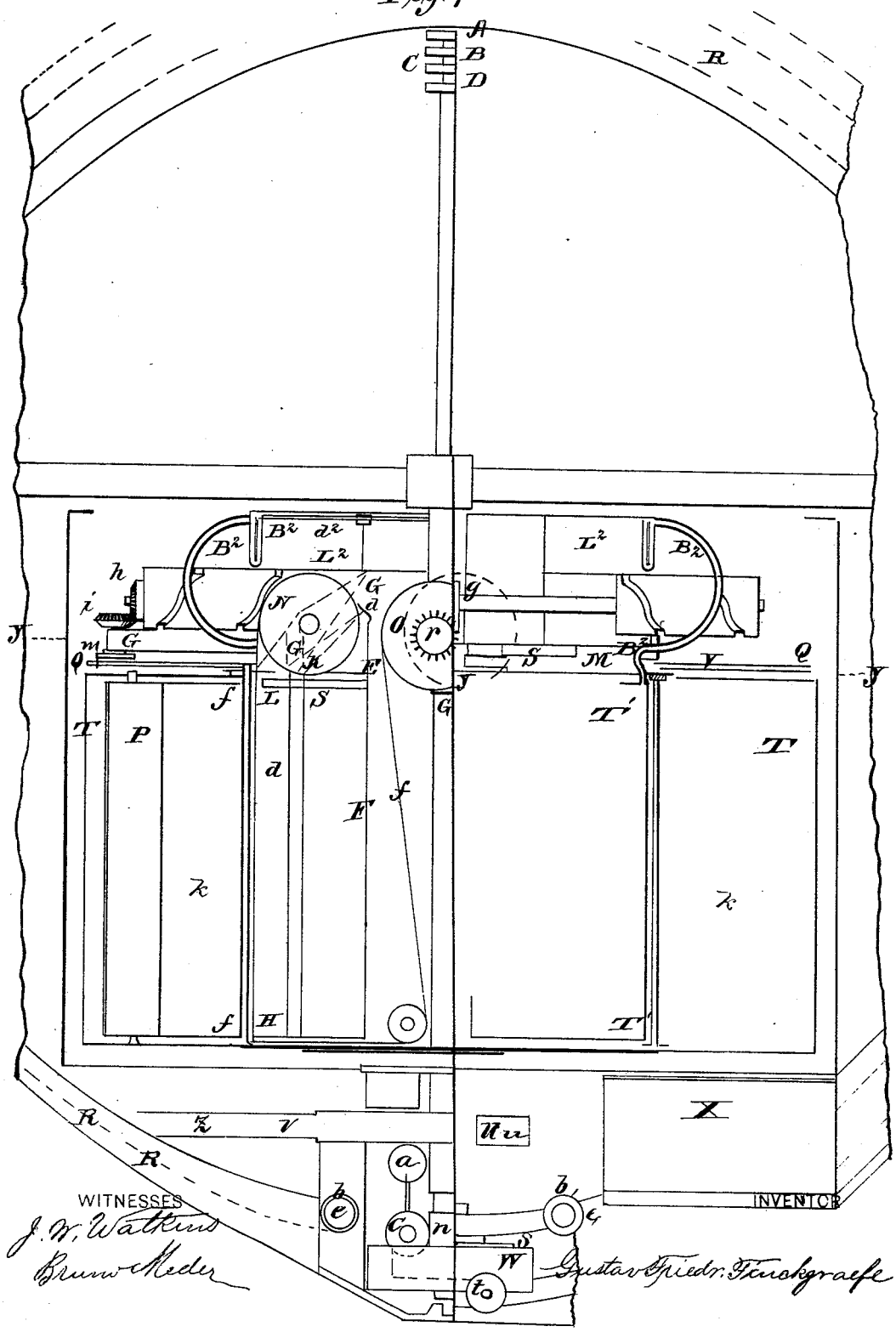
6 Sheets—Sheet 5.

G. F. FINCKGRAEFE.

Centrifugal Machine.

No. 218,670. Patented Aug. 19, 1879.

Fig. 1.



6 Sheets—Sheet 6.

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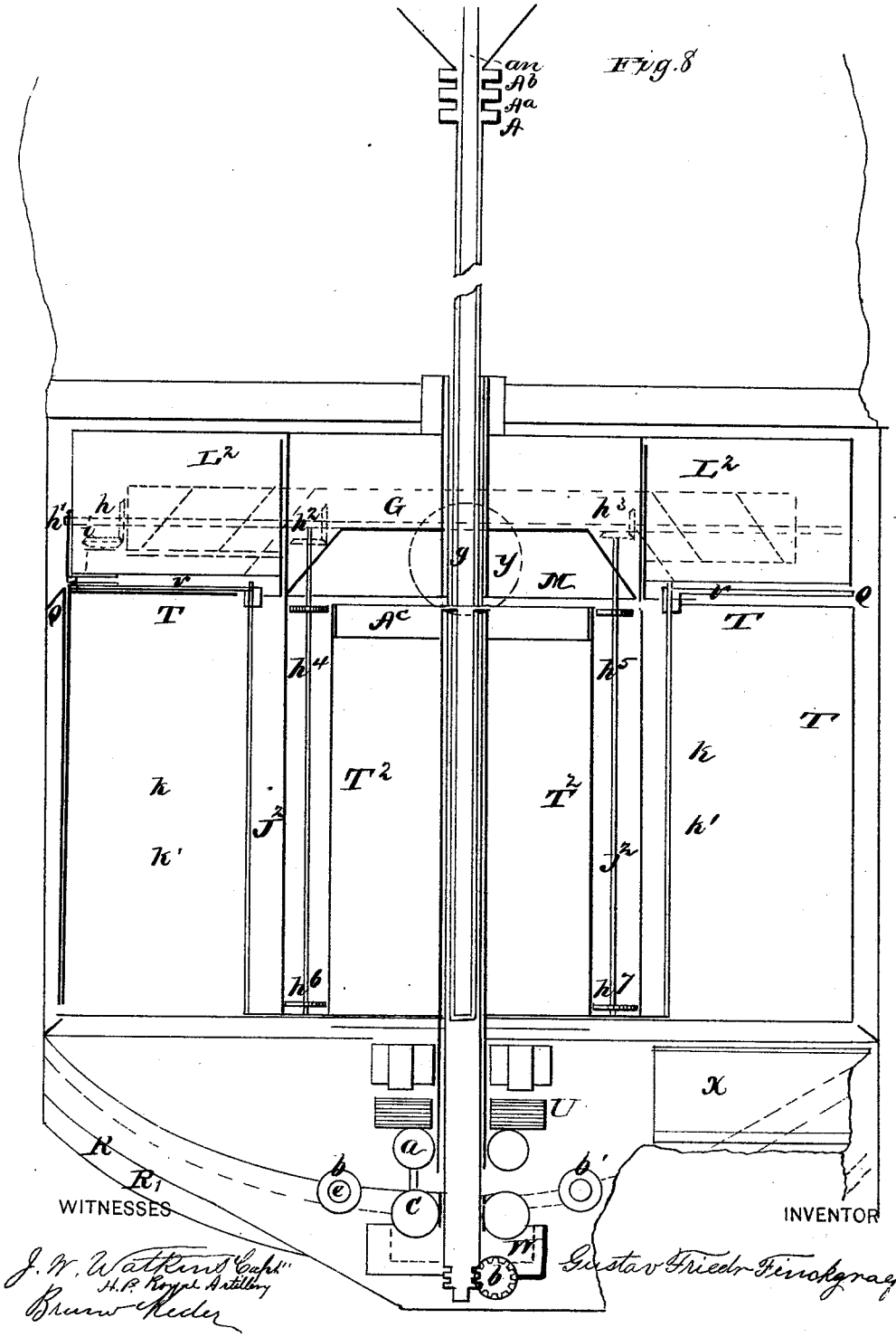

UNITED STATES PATENT OFFICE.

GUSTAVUS F. FINCKGRAEFE, OF PASSAIC COUNTY, NEW JERSEY.

IMPROVEMENT IN CENTRIFUGAL MACHINES.

Specification forming part of Letters Patent No. **218,670**, dated August 19, 1879; application filed January 3, 1879.

To all whom it may concern:

Be it known that I, GUSTAVUS FRIEDRICH FINCKGRAEFE, of the county of Passaic, State of New Jersey, United States of America, at present of Leipsic, Saxony, Germany, have invented certain new and useful Improvements in Centrifugal Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan view of the drum. Figs. 2, 5, 7, and 8 are vertical sections through the same. Fig. 3 is a side elevation of the machine. Fig. 4 is a plan view of the same. Fig. 6 is a plan or top view of the drum, showing the means for adjusting the hinged flap-partition; and Figs. 9 and 10 are detail views, showing the means for rotating the drum.

The object of my invention is to produce, by means of centrifugal action, a separation of the specifically heavier parts of any fluid from the specifically lighter portions of the same; and to effect this object a rotating drum is employed, provided with partition-walls that can be inserted while the drum is in motion, and without interfering with the rotary action of the same, for completing and maintaining the separation effected by centrifugal action.

The partition-walls may be arranged and inserted in four ways, as described below.

The vertical axis of the drum T is made hollow, and contains four movable rods, A B C D, each of which may be made to move independently of the others by means of a separate key. F represents a cylinder, of linen, parchment, or india-rubber, connected at one end with a tension-ring, E, and passing thence down under a flat ring, H, supported in close proximity with the bottom of the drum T by rods attached at their upper ends to a bail, G. The opposite end of the cylinder F is connected in gathered form to the lower end of a deep ring, *q*.

Fine wires *d* are extended from the tension-ring E up over pulleys J, and thence down to the ring *q*, serving to connect said rings and to hold the flexible cylinder under constant tension. Arms *q'* pass through slots in the hollow axle of the drum, and connect the deep ring *q* with the rod D in such manner that when the rod D is forced downward it carries the ring *q* with it, and the latter, acting through the wires *d*, draws the tension-ring up, and with it the cylinder F, causing the latter to rise outside of the ring H in enlarged or expanded form, (indicated by the dotted lines at F, Fig. 1,) and occupying the position formerly occupied by the wires *d* relative to the cylinder. A reverse movement of the rod D withdraws the ring *q*, forcing the tension-ring downward into contact with the ring H, causing the material forming the cylinder to pass under said ring, and to rise contracted in diameter to the diameter of ring *q* and the inner diameter of ring H, the parts assuming the position shown in Fig. 2. The cylinder F may thus be made to occupy either of the two positions shown, as the relative gravities of the liquids operated upon may require.

A second cylinder, L, of similar material to cylinder F, is connected at its upper end with the ring or cover M, and has its lower end connected with a tension-ring, *s*, connected by arching arms K with the slide-rod C. This cylinder is shown collapsed, like a paper lantern; but by forcing the rod C downward the ring *s* is carried down inside of the cylinder F, when the latter is drawn up by the ring E, and in close proximity with the inner face of said cylinder, for opening and stretching the cylinder L, and at the same time serving to scrape off any substance adhering to the inner face of cylinder F.

By the interposition of these cylinders F and L, after the separation of the heavier and lighter portions of the fluids or other material has been effected by centrifugal action, their separation is preserved until they can be withdrawn or removed through separate outlets for that purpose, as hereinafter described.

For the purpose of effecting further or more complete separation of the heavier and lighter portions of a fluid, a sheet of thin metal is employed, shown coiled up inside the drum at P upon a shaft extending up through a bearing-perforation in the upper end of the drum, and to the projecting end of which a crank-handle may be applied for winding up the sheet when not in use.

The upper and lower outer corners of the sheet have small wires *f f'* connected with

them, which pass around inside the drum, supported in flanged or angle rings, one at the upper and the other at the lower end of the cylinder. The upper wire, after passing entirely around its supporting-ring, passes through a perforation in the cover and over a guiding-pulley, N, to a grooved wheel, C, and the lower wire, f', after passing around its guiding-ring, is carried to near the center of the drum under a guiding-pulley, O', and passes thence up to the pulley O, as shown.

The wheel or pulley O has a spur-pinion, r, connected with it, which engages with a rack on the rod B in such manner that when said rod is pressed down, the wheel O, acting on the wires $f f'$, draws out the sheet P into cylindrical form, surrounding the angular guiding and supporting rings, causing it to assume the position indicated by the dotted line p', Fig. 1.

A separation may be effected by means of a series of flaps, k, connected at their inner ends or edges with vertical rock-shafts, which at their upper ends pass through the cover of the drum, and have toothed quadrants r attached to them, as shown. These quadrants engage with an annular rack, Q, having on one side a short rack-bar attached to it by brackets, lifting it above the plane of the toothed quadrants r. This short rack engages with a toothed wheel, m, on the lower end of an upright shaft, to the upper end of which a bevel-wheel, i, is applied, which engages with a bevel-wheel, h, on the outer end of a horizontal shaft, g', having at its inner end a spur-wheel, g, which engages with a rack on the sliding rod A.

Supposing the flaps to be open or thrown outward into the position shown in dotted lines, Fig. 1, in which position they serve to stir up and impart rotary motion to the liquid, after which, at the proper time, and when the separation has been effected by centrifugal action, by drawing the rod A upward, motion is communicated, through the rack and gears g, h, i, and m, to the annular rack Q, and thence to the quadrants r and flaps k, folding them inwardly against the angle-ring above described, in which position they unitedly form a separating-cylinder. (Indicated by the dotted lines in Fig. 6.) These flaps may be used either with the sheet P or as a substitute therefor.

Fig. 5 shows an arrangement for etching plates. A metal cylinder, T^1, is employed, which is inserted through the lower end of the drum T and attached to the cover M, with the bottom resting upon the removable bottom of the drum T. This cylinder T^1 is lined throughout with gutta-percha, or some other non-corrosive material, to protect it from the acids employed.

The plates to be acted upon are suspended within the drum T^1, and the acids being driven against the same, and being rapidly displaced and renewed by the centrifugal action, the action of the acid upon the metal is much more rapid than under the ordinary method of exposure.

To the upper end of the cylinder flexible hose B^2 B^2 are attached, connecting it with two crescent-shaped reservoirs, L^2, supported and adapted to slide laterally along the bent arms or bail G upon ways S^2. (See Figs. 5 and 6.) These reservoirs are moved simultaneously in and out by means of right-and-left-handed screws formed upon or attached to the shaft g', and are provided on their lower faces with angle-irons j, which, as the reservoirs are moved outward, serve to throttle the hose when it is desired to prevent the flow of the contents of the reservoir into the cylinder T^1.

To increase the utility of this extra drum T^1 the reservoirs L^2 may be fixed on the top of the drum M, and made to communicate therewith, in order to receive any overflow of the fluid with which the drum is filled in case the fluid be forced out by the introduction of foreign substances. This overflow may be effected in two ways—the first by means of a cylinder, T^2, having a double tin bottom, and secured to the bottom of the cylinder T, and having a piston, A^c, (the piston-rod passing through the hollow axle,) and air-tubes connecting the cylinder T^2 with air-cushions k', which may be readily fastened to the flaps.

If, during the rotation of the drum T, the piston-rod be pressed down, the piston of the air-pump A^c forces air into the air-tubes and cushions k', and the fluid which is thereby forced out is obliged to ascend into the reservoirs L^2. An india-rubber pipe attached to the piston is made by this movement to cover the axle, and to prevent the escape of the fluid through said axle.

If, in changing the contents of the drum, no stoppage is to be occasioned, the rod A must be made to move the shaft g', carrying at its outer end a toothed wheel engaging with a toothed rod, for operating a sliding valve in order to open up orifices in the reservoir and the drum, out of which the fluid can flow into channels in the metal plate-casing, whence it has free egress. The fresh fluid to be put in is poured in through the hollow axle by means of a funnel.

Again, a long strip of metal plate, J^2, may be used, bent into cylindrical form, and fitted, by means of india-rubber packing on its edges, to the interior of the vessel in which the fluid is being rotated. If, by means of the rod A, the wheel g, with its axle and beveled wheels h^2 h^3, be turned, and thus vertical axles h^4 h^5, carrying star-wheels h^6 h^7, be set in motion, the cylindrical strip of metal, which is packed on the inside and has its ends overlapping each other, will be extended or forced outward, and will thereby force the particles of fluid upward into the reservoirs L^2.

A cylinder of perforated plate metal or wire-gauze may be inserted into the cylinder T, for the purpose of retaining and exposing to the

action of the fluid any material containing soluble matter, such as cuttings of sugar, belts, &c.

The fluid which is allowed to enter through the hollow axle conveys the specifically lighter portions of the soluble matter toward the center of the drum, and thence into the reservoirs L^2, while the specifically heavier portions are carried outward to the periphery, and finally to the outlets controlled by the sliding valves named above. The centrifugal force at the same time drives any foreign matter put in for the purpose of purification or neutralization forcibly into the mass of the fluid, while the least saturated portions of the fluids are allowed to remain in contact with the matter to be taken up in solution.

The rotary drum is operated by the following mechanism: The friction-wheel W, which is moved by the driving-wheel R, is furnished with an elastic rim for the purpose of increasing the friction. In order, however, to avoid as much as possible any oscillation being communicated by the driving-disk R, the inner rim of the same is provided with a friction-roller, S, pressed by means of the spiral springs *e e*, attached to the clamps *b b*. On the friction-wheel W a ball-governor, *a*, is fixed, the eccentric disks *c c* of which move a weight, *n*, upward as soon as the speed of the drum becomes greater than is, indicated by the numerator moved by the wheel *t*. The result produced is, that the weight raises a hollow casing on the axle of the drum, but capable of a vertical motion, to which the bar of a horse-shoe-magnet, U, is attached, thus causing the action to cease.

The rotary drum is furnished with a fixed shield of sheet metal, the bottom of which is provided with a furnace, X, so that when required the fluid to be subjected to the rotary action of the machine may be raised to any given temperature.

The rotation of the drum is effected by means of a movable platform, Y, acted on by the action of the feet of a draft-animal.

The driving-axle is furnished with a wheel, R′, in addition to and of the same size as the driving-disk R, so that the whole apparatus may be wheeled about from place to place, and, if necessary, overturned for the purpose of being cleaned out.

The apparatus does not occupy much space, although the drum is driven directly by the driving disk, as the latter is sunk nearly a semi-diameter in the drum. All the parts to which motion is communicated are protected with guards.

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

1. In a centrifugal machine for effecting the separation of fluids or other substances of different specific gravities, a rotating drum provided with one or more movable partitions, in combination with the rods moving through the hollow axis of the drum for throwing said partitions into and out of action while the machine is in operation, substantially as described.

2. The combination, with the rotating drum, of the partition-cylinder F and the collapsing cylinder L, arranged and operating substantially as described.

3. The combination, with the drum T, of the cylinders F and L, sheet-metal partition P, and the series of flaps K, forming the movable partitions, substantially as and for the purpose described.

4. The movable partitions applied to the drum, in combination with the rods A, B, C, and D, operating through the hollow axis of the drum, for controlling and adjusting said partitions, substantially as described.

5. The driving disk or rim R, for operating the drum T, in combination with the friction-wheel W and yielding friction-roller S, for steadying the movement of said disk or rim, as described.

6. The rotating drum T, for effecting the separation of fluids of different specific gravities, in combination with the furnace X, whereby the fluids can be raised to any required temperature.

GUSTAVUS FRIEDRICH FINCKGRAEFE.

Witnesses:
J. W. WATKINS,
BUNSO MEDER.