(No Model.) 3 Sheets—Sheet 1.

C. PARHAM.

CENTRIFUGAL MACHINE.

No. 574,933. Patented Jan. 12, 1897.

FIG. 1.

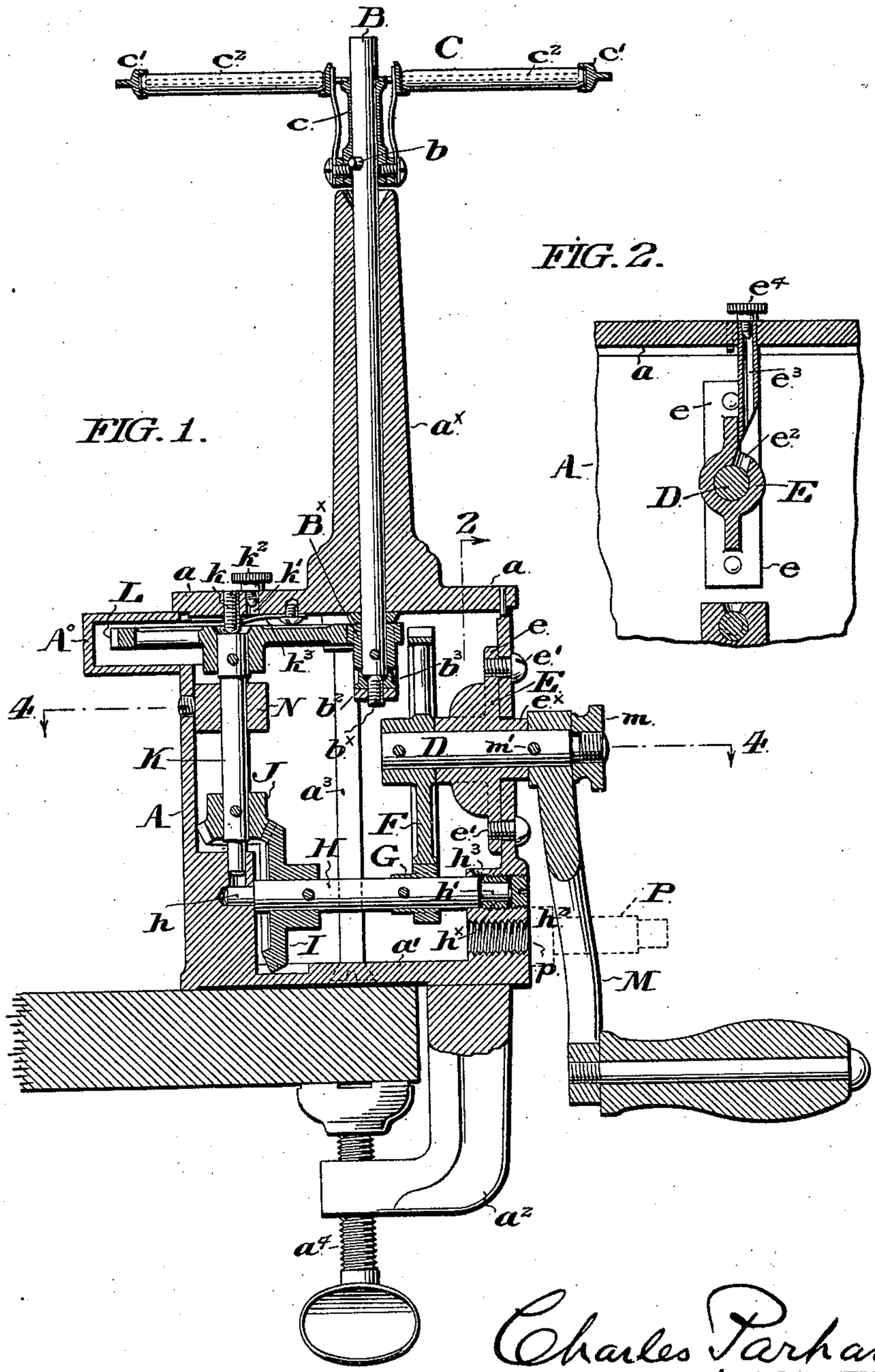

FIG. 2.

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F. Norman Dixon

(No Model.) 3 Sheets—Sheet 2.

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FIG. 3.

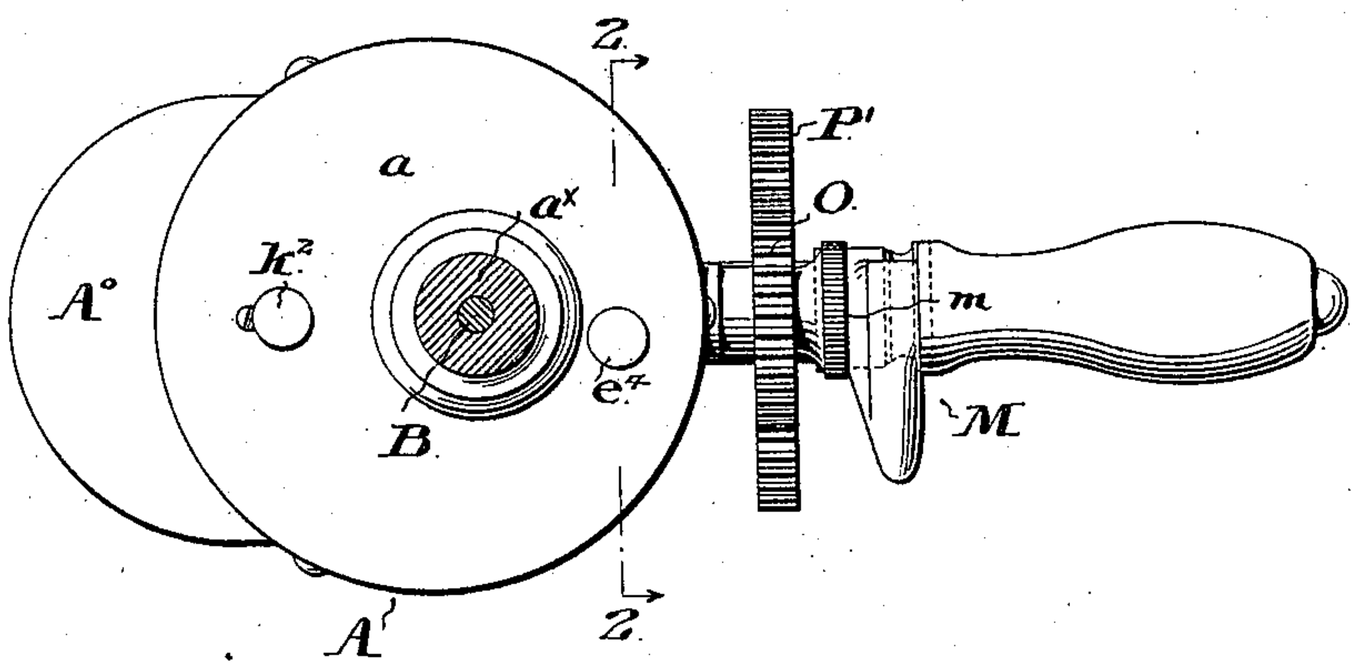
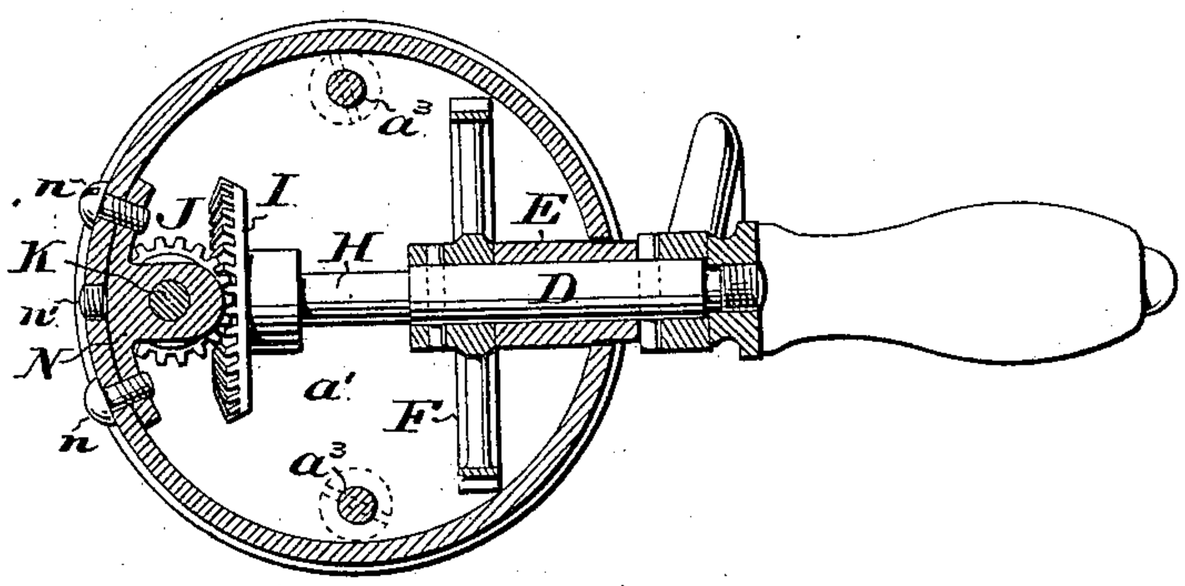


FIG. 4.



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(No Model.) 3 Sheets—Sheet 3.

C. PARHAM.

CENTRIFUGAL MACHINE.

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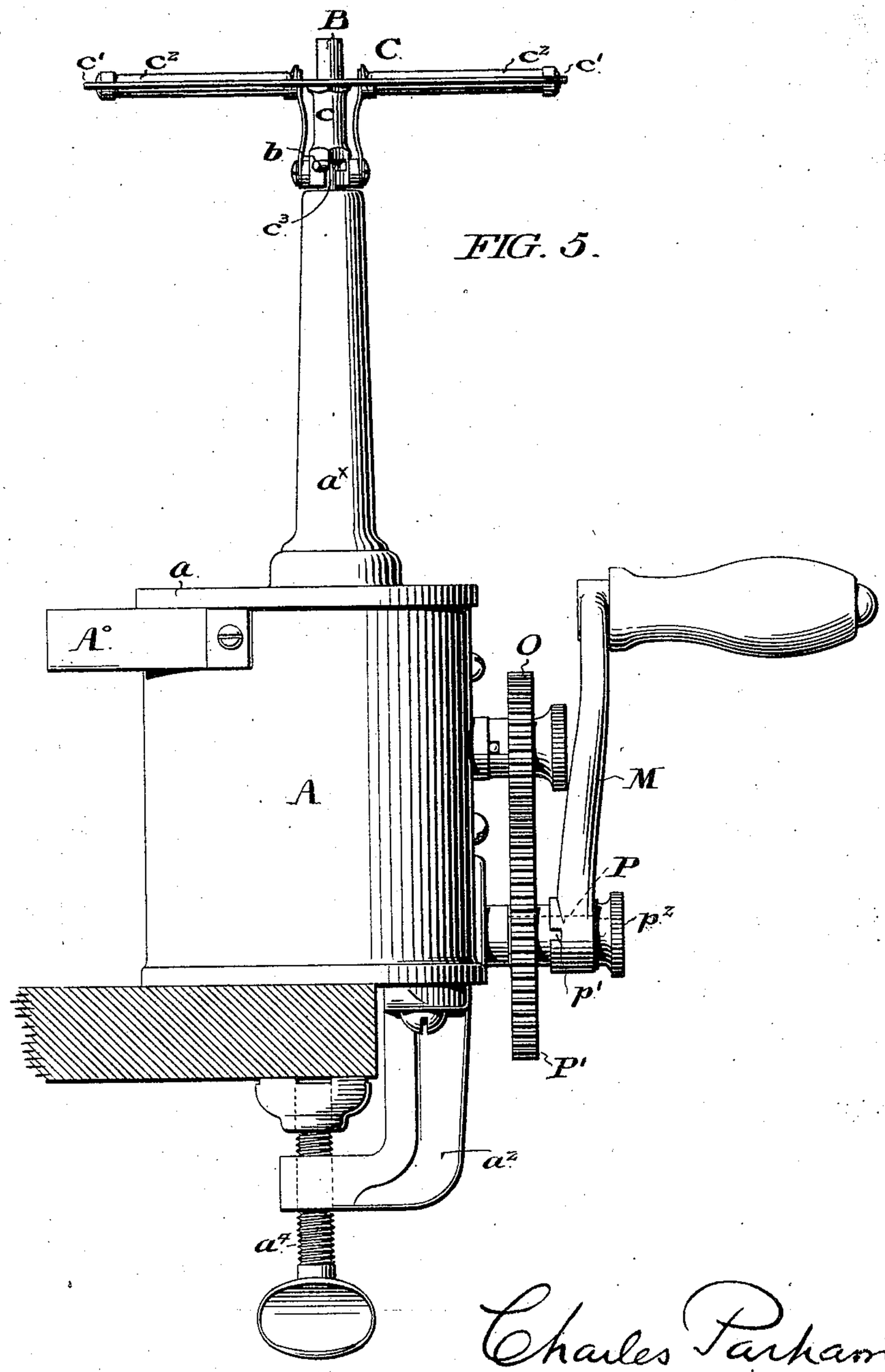

FIG. 5.

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UNITED STATES PATENT OFFICE.

CHARLES PARHAM, OF PHILADELPHIA, PENNSYLVANIA.

CENTRIFUGAL MACHINE.

SPECIFICATION forming part of Letters Patent No. 574,933, dated January 12, 1897.

Application filed January 11, 1896. Serial No. 575,105. (No model.)

To all whom it may concern:

Be it known that I, CHARLES PARHAM, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Centrifuges, of which the following is a specification.

My invention relates to a class of devices intended for laboratory use, employed for separating, according to their specific gravities, for purposes of analysis, the several elements entering into the composition of liquid bodies of various kinds, said devices being operated by centrifugal force developed by rotating liquid-containing receptacles at high rates of speed.

My present invention is especially designed to enhance the efficiency and durability and to lessen the cost of construction of such devices as heretofore manufactured.

In the accompanying drawings I show and herein I describe a good form of a convenient embodiment of my invention, the particular subject-matter claimed as novel being hereinafter definitely specified.

In the accompanying drawings, Figure 1 is a central vertical sectional elevational view of my improved centrifuge. Fig. 2 is a sectional elevation, section being supposed on the dotted line 2 of Fig. 1, and sight being taken in the direction of the arrow applied to said line. Fig. 3 is a top plan view of the apparatus. Fig. 4 is a horizontal sectional plan, section being supposed on the dotted line 4 4 of Fig. 1. Fig. 5 is a view in side elevation of my improved device.

Similar letters of reference indicate corresponding parts.

In the accompanying drawings, A is a casing, preferably cast as a hollow cylindrical body, having the eccentric extension A°, and having a top a, provided with an upwardly-extending spindle-bushing $a^{\times}$, and an integral bottom a', provided with an angle-arm a^2, said top being held and clamped to the bottom by the bars or screws a^3, as shown in the drawings. The angle-arm a^2 is adapted to extend beneath the edge of a table or support upon which the structure rests, and the structure is firmly secured to said table or support by a clamp-screw a^4, passing through said angle-arm and bearing against the under face of said table, as shown in Figs. 1 and 5.

B is a spindle mounted for rotation within the spindle-bushing $a^{\times}$, above which its upper end protrudes, and provided as to said upper end with a stud b.

C is a rotating holder, the same consisting of a sleeve c, snugly fitted to the upper end of the spindle, and provided with a laterally-extending frame c', of any preferred construction, adapted to support liquid-containing vessels c^2 of any variety. The form of said frame and of the liquid-containing vessels constitutes no part of my present invention, and further description of them is omitted because well known to those familiar with the art. It is, however, desirable in the use of centrifuges to have a number of different holders, which may be employed in connection with different liquids, and further desirable that such holders should be not only quickly applicable to and removable from the spindle, but should be firmly secured thereon to prevent accident during the operation of the device. Accordingly I provide the lower edge of the sleeve c of each holder with a vertical recess c^3, provided with two lateral recesses, and in applying a holder to the spindle I mount its sleeve on the upper end of the spindle and move it down the same until the stud b enters the recess c^3 and comes into contact with the edge or top of the recess. When, then, the spindle is rotated, the stud b moves into one or the other of the lateral recesses, according to the direction of such rotation, and, encountering the end of the entered recess, thereafter carries the holder around with it.

As will be understood, the stud b will enter one or the other of the lateral recesses, in whatever direction the spindle may rotate, with the result that the stud being thus engaged, the frame will be secured against flying off. As will be understood, said frame may be very quickly applied to and removed from the spindle.

In order to impart motion of rotation to the spindle, I resort to the following arrangement of gearing:

D is a driving-shaft mounted in a sleeve E supported in the wall of the casing, equipped

at its inner end with a driving spur-gear F in mesh with a driven pinion G on a horizontal idle-shaft H situated in the lower portion of the casing, and the respective extremities *h h'* of which idle-shaft are entered in bearings formed in thickened portions of the wall of the casing.

I is a driving bevel-gear mounted on said horizontal idle-shaft H, in gear with a corresponding bevel-gear J on the lower end of the counter-shaft K, the upper end of which is equipped with a driving spur-gear L in mesh with the driven pinion $B^{\times}$, mounted on the lower end of the spindle B.

M, Fig. 1, is an operating crank-handle, applied to the outer end of the shaft D. As will be understood, rotation imparted to said handle M will through the train of gearing described be imparted to the spindle B, the arrangement of gearing shown being one by virtue of which the spindle will be rotated many times at each revolution of said handle.

As is well known, it is difficult to arrange the shafts of gearing, entered in bearings bored in castings, where a number of such shafts are employed, in such manner that the gears mesh accurately with each other, without the expenditure of much time and consequent increase of cost.

It is one of the purposes of my invention to so arrange and mount the several shafts that the parts may be expeditiously assembled, and when assembled be accurately fitted to each other so that the apparatus shall operate without lost motion or undue wear on the teeth of the gears.

The supporting-sleeve E accurately fits the shaft D, and is provided with lateral extensions or ears *e* which rest against the inner face of the wall of the casing, and an extension $e^{\times}$ which extends through an opening in said wall. Screw-openings are formed in said wall at either side of the opening through which the sleeve extends, and tapped openings are formed in the ears *e*, in which screws *e'*, extending through the screw-openings, are entered.

The opening in the wall of the casing through which the sleeve extends is slightly larger in diameter than said sleeve, and the screw-openings in said wall are slightly larger in diameter than the screws *e'*, with the result that said sleeve, carrying the shaft D, may be slightly adjusted in the wall-opening by being moved up or down or in any direction, to carry the teeth of the spur-gear F into accurate engagement with the teeth of the pinion-wheel G, the screws *e'* finding corresponding freedom of movement in the screw-openings, and when the sleeve E is brought to proper position, it may be secured in such position by tightening up the said screws *e'*. e^2, Fig. 2, is an oil-opening in said sleeve, leading to the shaft D. e^3 is a depending tube opening through and mounted in the top plate *a* of the casing, and terminating just above said opening e^2. e^4 is a screw-cap fitted within and closing said oil-tube to protect it from dust. As will be understood, upon the removal of the cap, oil supplied to said tube will be conducted to the opening e^2, for the lubrication of the bearing of the shaft D and the journal end of the shaft H.

The reduced end *h* of the shaft H is simply entered in a bore formed in the thickened portion of the wall of the casing. As, however, great strain or pressure is put, through the spur-gear F, upon the pinion-wheel G mounted upon the opposite end of said shaft H, I provide in the wall of the casing for the last-mentioned end of said shaft an opening considerably larger than the reduced end of said shaft, and mount within the threaded interior of said opening a bushing $h^{\times}$ of brass or other very tough metal, adapted to receive the end of said shaft, and exteriorly threaded to adapt it to the interior of said wall-opening. h^2 is a retaining-screw mounted in the outer end of said wall-opening.

h^3 is a top opening in the thickened portion of the wall in which the end *h'* of the shaft H is entered, said opening leading to the inner end of said bushing $h^{\times}$, and being situated beneath the tube e^3. As a result of this arrangement oil entering said tube e^3 and overflowing from the opening e^2 will enter said opening h^3 for the lubrication of the bearing of the shaft H.

N is a supporting-block through which the shaft K extends, said block being, as shown in Fig. 4, secured to the wall of the casing by a pair of screws *n n* and a set-screw *n'*, the first mentioned of which pass through openings in the wall of the casing of greater diameter than themselves.

The screws *n n* pass through untapped openings in the wall of the casing and are entered in tapped openings in the block N. The set-screw *n'* passes through a tapped opening in the casing and bears against the block N.

As will be understood, by manipulation of said screws the block N may be set a greater or less distance from the wall of the casing, and moved laterally for a distance equal to the difference between the diameters of the screws and the wall-openings in which they are set, to carry the shaft K into such position that its wheels J and L are in accurate mesh with the wheels I and $B^{\times}$, respectively.

k is a set-screw mounted in the cover-plate of the casing, the inner or advanced end of which rests upon the upper end of the shaft K, to resist upward thrust of the same under the operation of the bevel-gears.

k' is an oil-opening in the cover-plate closed by a screw-cap k^2.

k^3 is a small metal or other inclined plate secured to the under face of the cover-plate *a*, passing beneath the oil-opening *k'*, and terminating over the end of the shaft K. As will be understood, oil passing through said opening *k'* will be conducted by said plate to the point of frictional contact between the set-screw *k* and the shaft K.

The lower end of the spindle B rests and rotates upon the point of a set-screw $b^{\times}$ mounted in a bracket-arm b^2, shown in Fig. 1. b^3 is a jam-nut applied to said screw to prevent it from becoming unscrewed by the action of the spindle.

As, in the separation of fluids, some require a greater degree of centrifugal force than others, and consequently a higher speed of rotation of the apparatus, I provide my improved centrifuge with a changeable gear, so that with a given manual rotation of the handle M, the rotating holder may be rotated at a higher or lower speed, as required.

The arrangment shown in Fig. 1 illustrates the ordinary gearing of the apparatus. Where a very high rate of speed of rotation of the spindle and rotating holder is required, I unscrew the nut *m*, Fig. 1, and withdraw the handle M, the hub of which has, at its inner end, as shown in Fig. 4, recesses which receive a fixed pin *m'*, applied to the shaft D, from said shaft D. I then apply to said shaft a gear O, Fig. 5, having a hub provided with recesses which receive said pin *m'*, and there secure said gear by restoring the nut *m*. I then insert a screw shaft or stud P in the tapped opening *p*, Fig. 1, upon which shaft I mount a gear P', the hub of which has studs *p'*, over which the recesses in the hub of handle M fit when said handle is, as shown in Figs. 3 and 5, also mounted on said shaft. A nut p^2 mounted on the outer end of said shaft secures both the handle M and the gear P' upon the shaft P.

The arrangement and proportions of the two gears O and P' are such that the number of rotations imparted to the spindle B at each rotation of the handle M will be greater than the number imparted to said spindle when the handle is mounted on the shaft D.

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

1. In a centrifuge, a casing, two shafts mounted in the side of said casing, the first of which shafts is provided with a projection, a spindle mounted in said casing, a test-tube holder mounted on said spindle, a train of gearing within the casing in gear with the first of said shafts, through which gearing rotation is imparted from the first of said shafts to the said spindle, a pair of gear-wheels removably applied to the protruding extremities of said shafts, the gear-wheel mounted upon the first shaft being provided with a recess on its inner face adapted to make locking engagement with the projection on the shaft, and the gear-wheel mounted upon the second shaft being provided with a projection on its outer face, a recess-provided handle removably applied at will to either of said shafts, and adapted to make locking engagement with either the projection on the first shaft or the projection on the gear-wheel on the second shaft, substantially as set forth.

2. In a centrifuge, in combination, a casing, a spindle revolubly mounted in the casing, a test-tube holder, a shaft mounted in and projecting through the wall of the casing, and means for imparting rotation to the same, and gearing connective of said shaft and the spindle, as a means for adjustably supporting said shaft, a sleeve surrounding said shaft and mounted in an opening in the casing of diameter in excess of its own, and screws mounted in lateral extensions of said sleeve and extending through openings in the casing of diameter in excess of their own, substantially as set forth.

3. In a centrifuge, a casing, a spindle revolubly mounted therein, a test-tube holder mounted on said spindle, a shaft revolubly mounted in the wall of the same and equipped with a gear-wheel, a horizontal idle-shaft provided with a driven wheel in mesh with said gear-wheel and with a driving bevel-wheel in mesh with a driven bevel-wheel mounted on a vertical counter-shaft which is equipped with a driving spur-gear from which rotation is imparted to the spindle, as a means for adjustably supporting said counter-shaft to place its wheels in accurate mesh with other wheels, a block embracing said shaft, and a plurality of screws engaged with said block and passing through openings in the wall of the casing of diameter in excess of their own, and a set-screw engaged in a tapped opening in the wall of the casing and bearing against said block, substantially as set forth.

4. In a centrifuge, a casing, a spindle revolubly mounted therein, a test-tube holder mounted thereon, a shaft revolubly mounted in the wall of the casing and equipped with a gear-wheel, a sleeve surrounding said shaft and mounted in an opening of diameter in excess of its own, in the casing, and screws mounted in lateral extensions of said sleeve and extending through openings in said casing of diameter in excess of their own, an idle-shaft provided with a driven wheel in mesh with said gear-wheel and with a driving bevel-wheel in mesh with a driven bevel-wheel mounted upon a vertical counter-shaft which is also equipped with a driving gear-wheel through which rotation is imparted to the spindle, a block embracing said counter-shaft and a plurality of screws engaged with said block and passing through openings, of diameter in excess of their own, in the wall of the casing, substantially as set forth.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 3d day of January, A. D. 1896.

CHARLES PARHAM.

In presence of—

F. NORMAN DIXON,

THOS. K. LANCASTER.