No. 780,315. PATENTED JAN. 17, 1905.

H. E. WETHERILL.

HAEMATOKRIT.

APPLICATION FILED AUG. 5, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

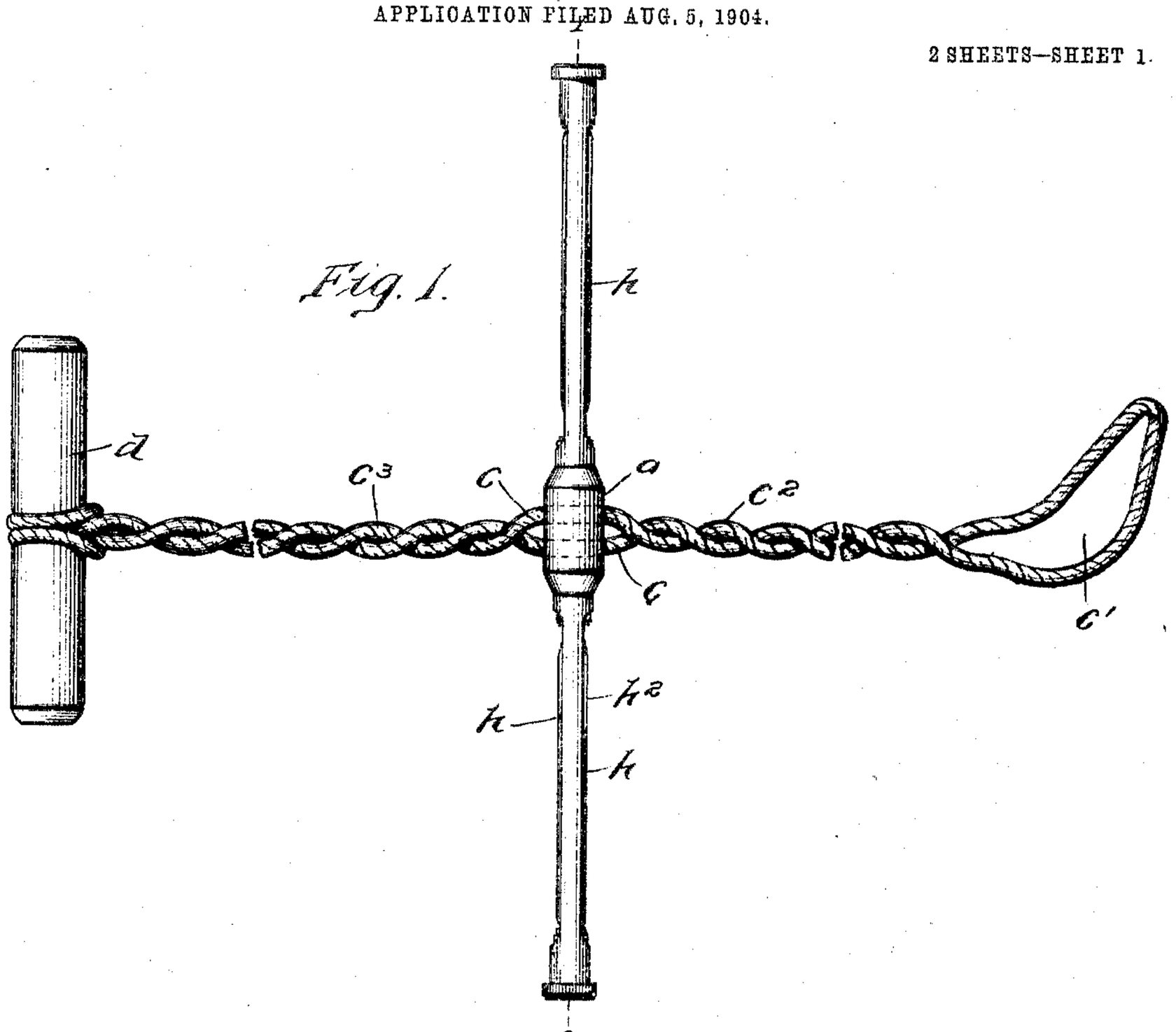


Fig. 2.

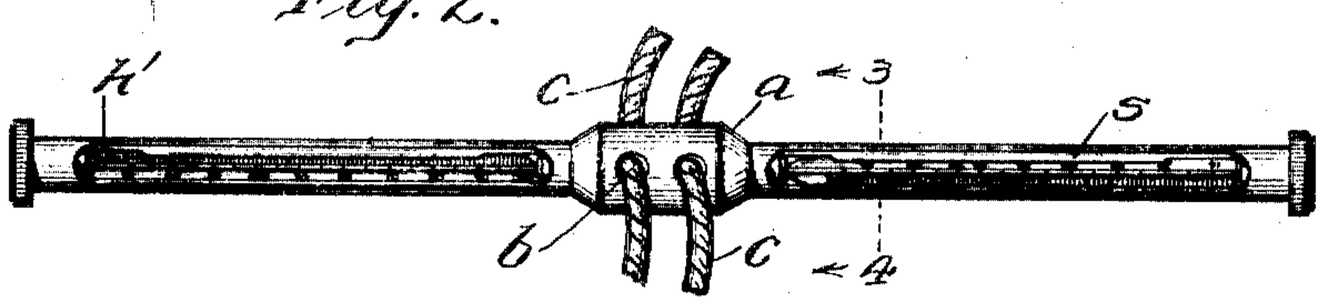


Fig. 3.

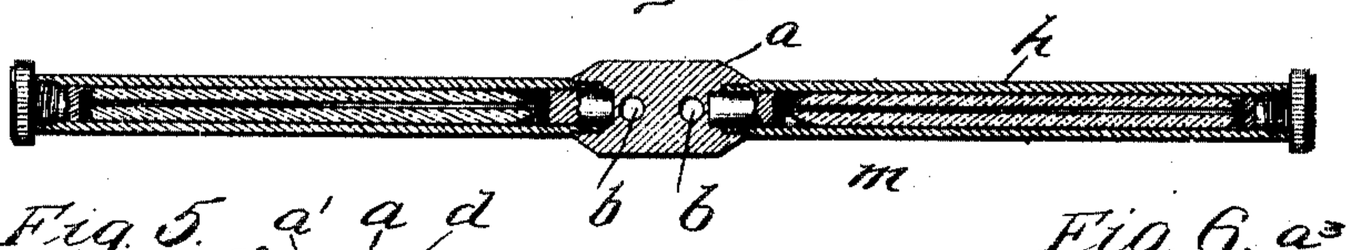


Fig. 5.

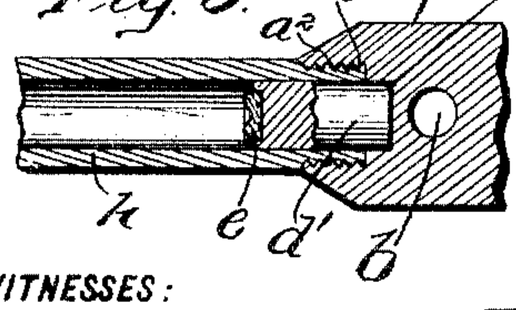


Fig. 4.

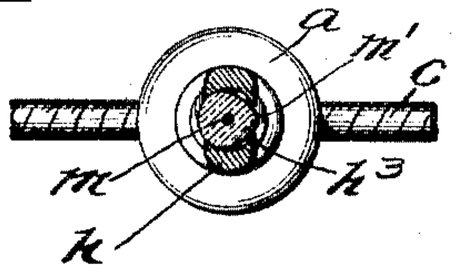
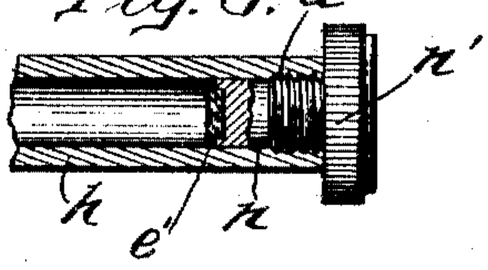


Fig. 6.



WITNESSES:

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2 SHEETS—SHEET 2.

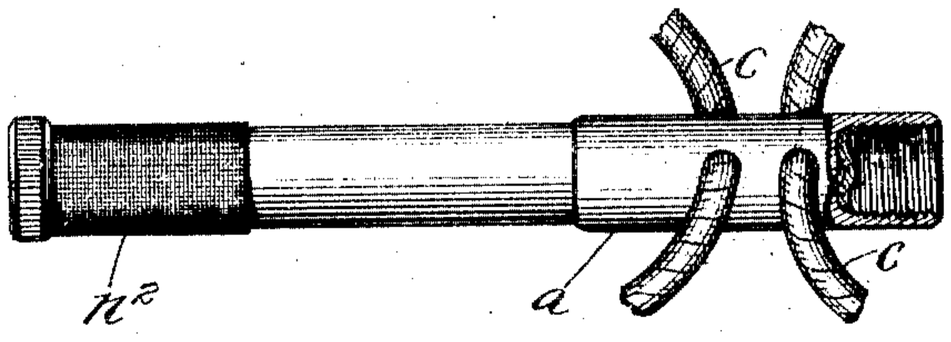


Fig. 7.

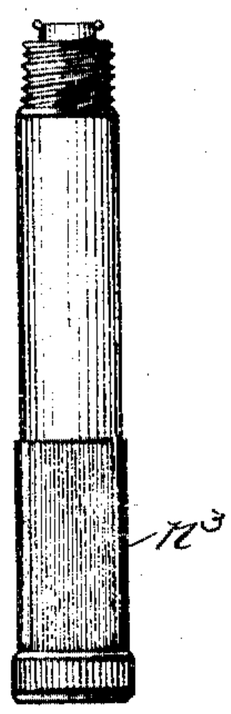


Fig. 8.

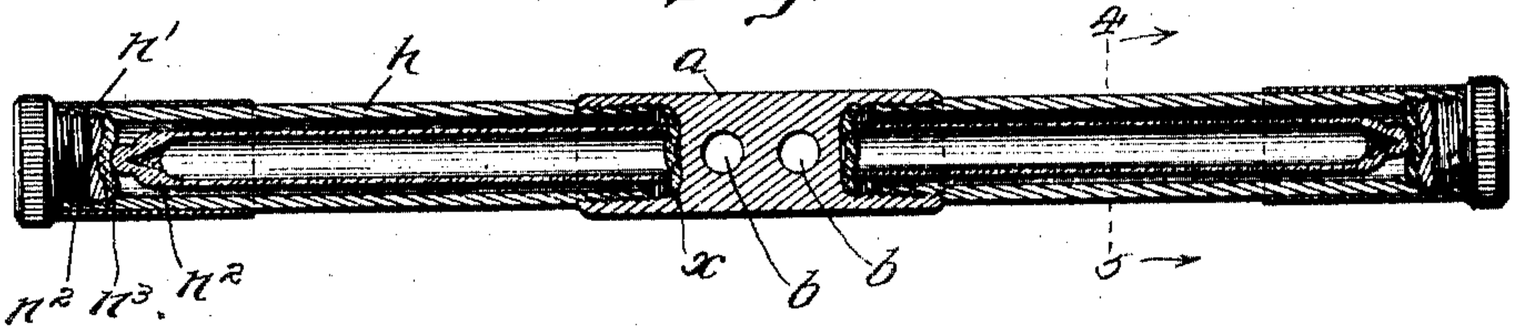
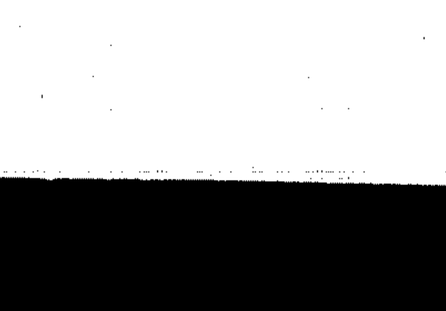


Fig. 9.



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No. 780,315. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

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HAEMATOKRIT.

SPECIFICATION forming part of Letters Patent No. 780,315, dated January 17, 1905.

Application filed August 5, 1904. Serial No. 219,615.

To all whom it may concern:

Be it known that I, HENRY EMERSON WETHERILL, a citizen of the United States, residing in the city of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Haematokrits, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to instruments used in pathologic diagnosis and other scientific and commercial clinical work for the separation and precipitation in a graduated test-tube or other like containing vessel of the contained solids in the liquid treated. These devices have come to be known by the generic name "haematokrit" when applied to the separation and precipitation of blood-corpuscles and by the specific name "centrifuge" when applied to the separation of solids in urine, human and other milk, chemical precipitates, pharmaceutical mixtures, &c. All such instruments operate on the principle of quick separation of the contained solids by rapid centrifugal motion given to the test-tube containing the liquid acted on. Complicated mechanical means are commonly employed in such devices to support the tube and impart this character of motion to it. Moreover, all such devices operate to rotate the test-tube in a horizontal plane and in one direction only.

My invention has for its objects to provide a holder or carrier for the test-tube which will support the tube under rotation in a vertical or other positioned plane and enable it to be rotated in both directions, which will enable the insertion and withdrawal of the tube from the holder with facility, which will stop the mouth of the tube temporarily without the interposition therein of a cork or other like closing device, or, indeed, of any segregable means apart from the holder and its adjunctive elements, and which will support the tube in a fixed position temporarily in the holder, so that it will not rotate therein and so that the readings upon the index-scale may be had while the tube is so held therein; and, finally, my invention consists in simple mechanical means applicable and applied to the tube-holder whereby the latter may be rotated centrifugally in a vertical or other plane with increased rapidity and in both directions alternately.

To these ends my invention consists of the device hereinafter described, the novel features of which, both elementally and in combination, will be pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of one form of the device. Fig. 2 is a plan view thereof. Fig. 3 is a longitudinal section of the tube-holder on the line 1 2 of Fig. 1. Fig 4 is a section on the line 3 4 of Fig. 2 looking to the left. Fig. 5 is an enlarged section of the stopper end of the holder with the bottle removed. Fig. 6 is an enlarged section of a detached portion of the central body and inner end of the tube-holder. Fig. 7 is an elevation of a modified form of holder designed to carry a tubular body instead of a test-tube, one leg of the holder being detached to illustrate a detail. Fig. 8 is a longitudinal section thereof, and Fig. 9 a cross-section on the line 4 5 of Fig. 8 looking to the right.

The construction of the tube-holder in my device, while involving several novel and valuable features, has largely been subordinated to the rotating means, the latter being the chief feature of my invention, and I will therefor describe it first.

The central hub *a* is a substantially solid metallic body, preferably cylindrical, save at its opposite ends, these latter being bored out, as hereinafter described, to support two oppositely-disposed tube-holders. Transversely through its solid center it is bored to provide a pair of holes *b b* to admit the passage of two cords *c c*, which are united in a loop *c'* at one end and tied together and around a grasping-bar *d* at the other end. The loop *c'* being supported on a nail, hook, or door-knob, the handle-bar *d* is grasped by the hand of the operator with the cords passing between the fingers. Manual rotation of the tube-holder for a dozen or more turns will twist the cords in one direction on one side of the tube-holder, as at c^2, and at the same time twist the cords in the opposite direction on the other side of the tube-holder, as at c^3. The result will be

necessarily to shorten the cord, and this, followed by a gentle pulling and releasing alternately of the cord by means of the handle, will impart an exceedingly rapid centrifugal motion to the tube-holder. The rotation of the tube-holder will begin from right to left, or vice versa, and then both alternately, the direction of the initial motion depending upon the direction of the twists given to the cord by the initial manual rotation of the tube-holder. The means described to impart such centrifugal motion to such a body are simple and effective, and the great rapidity of the rotation is limited only by the number of the twists initially given to the cords.

The central hub or body *a* is constructed to contain a tube-holder at each end. In other words, the device is or can be made in duplicate in respect of the test-tube supports, and this is exceedingly desirable, as tests of blood and urine or perspiration can be made at the same time in the one instrument, using opposite ends thereof.

It will be observed that the hub or body is the portion directly rotated through the means provided to impart to it the centrifugal motion desired, and hence it is desirable, if not essential, that its opposite axes of rotation be central of its length or that its opposite ends be not so unevenly weighted as to throw it out of balance. Hence, as shown in the drawings, the holes through which the cords pass are substantially central and the hub carries duplicate test-tube holders on each end, though it is obvious that, if desired, it may also carry another pair of like tube-holders transverse to the others. My device enables separations of fluids to be made at both ends simultaneously, aided by air-tight filled tubes, and the latter, as I construct it, is filled by capillarity at the conical end. The device is light and portable and wholly new, in that there is not known a straight-tube centrifuge.

Each of the opposite ends of the hub or body *a* is bored lengthwise in two diameters, the larger being screw-threaded, as at *a'*, Fig. 5, to receive the screw-threaded inner end of the tube-holder *h*. The smaller bore *d*, of slightly greater length, receives the end of the plug *d'*, which fits the interior of the tube-holder *a*. The opposite end of this plug *d'* is cupped to receive and hold a buffing-washer *e*, for against it the bulb end of the test-tube *m* abuts when the parts are assembled in operative relation. The test-tube *m* is an ordinary tube having an index-scale *s* marked upon it and is of well-known character, except that its bulbous end has magnifying properties and a conical interior opening into the same, so that some of the precipitated solids will be opposite the magnifying bulbous walls. The tube is also peculiarly novel in that opposite segments of it slightly above the diametric center are shaped to give either a straight edge or a long curve, whereby the segmental edges meet each other in a short angle, forming a point *m'* (see Fig. 4) in order that these edges will afford a contacting surface for means, hereinafter described, within the tube-holder to prevent the tube from rotating within the holder. The tube has preferably a slightly-opened ridged mouth, so that it can be exactly filled by the tube-closing plug or washer hereinafter described.

The tube-holder *a* is substantially a hollow cylinder, one end of which is exteriorly screw-threaded at a^2 (see Fig. 5) to mount it in the hub or body *a*, while the other end is interiorly screw-threaded at a^3 to receive the removable closing-plug *n*, (see Fig. 6,) which is cupped at its inner end, preferably in a dovetail form, to receive and hold a washer *e'*, which operates not only to close the mouth of the tube like a cork closing-disk when the parts are assembled in operative relation, but to hold the tube firmly (but sufficiently yielding for glass) in the tube-holder during rotation of the device. The closing-plug *n* is provided at its outer end with an operating-button *n'* and is exteriorly screw-threaded at a^3 for a part of its length to thread with the open end of the tube-holder *h*.

In the operation of the device the test-tube is supplied with blood, sputum, urine, chemical mixtures, suspended solids, immiscible prescriptions, or whatever is to be separated, as usual with such devices. The tube is inserted in the tube-holder by its closed bulbous end or the reverse in getting percentage of absolute fat in milk, sweat, or where there is a small amount of a lighter substance to be separated and the closing-plug then applied, the inner washered end of which will contact with the mouth of the tube, closing it and holding it firmly in place within the tube-holder.

The tube-holder is preferably made of aluminium to secure lightness and for the same purpose is fenestrated on opposite sides for the greater part of its length, as at h' h^2, Fig. 1; but the upper fenestration h', Fig. 2, is provided for two additional purposes—namely, to enable the index-scale on the tube to be seen through it when the tube is in operative position in the holder, and by slightly rolling down the rim edges h^3 (see Fig. 4) of the fenestration h' these edges will abut against the opposite walls of upper segments of the tube on each side of the point *m'* and keep the test-tube from rotating within the holder, at same time holding it so that the index-scale is always opposite the fenestration h'.

Sometimes it is desirable to use in these devices a long bottle, with or without any index-scale on it, rather than a test-tube, and without any segmental bracing edges. Hence I have shown in Figs. 7 to 9 a modification of the device to adapt it to such use. The tube-holder *h* need not be fenestrated, except for lightness, if desired. Instead of a screw-

plug n a screw-cap n' is provided. The tube-holder is duplicated, as before, one on each end of the hub or body a, and in order to use one tube for blood and the other for urine, for example, the exterior surface of the closing-caps may be cross-lined, as at n^2 n^3, Fig. 7, to indicate different contents. In this modified form of the device the hub or body a is bored in one diameter to hold the washer x and support the holder h by its screw-threaded end, said washers held in a countersunk, as before, and operating also to close the bottle-mouth while the parts are in operative relation. In removing the bottle m the holder h is best removed by unscrewing its connection with the hub or body, and in assembling the parts for operation the position of the bottle in the holder is preferably the reverse of that employed in the form of the device shown in Figs. 1 to 6. The extreme or outer end of the holder is closed by the screw-cap n', as before stated, and it preferably carries a plug end n^2 to support a washer n^3, (see Fig. 8,) against which the bulbous closed end of the bottle rests. The hub or body a is bored to provide a pair of centrally-disposed and outwardly-beveled transverse holes b b, through which the operating-cords c c pass, as in the first-described form of the device, and the same means are employed, operating in the same way, for imparting centrifugal motion to the hub and to the bottle-holders carried thereby.

It is to be observed that while I have shown the operating-cords as a pair or double on each side of the hub and two transverse holes through the latter this is because textile cords are made up of twisted strands and must be used double; but if leather cords be substituted they can be used singly on each side of the hub or body of the device and correspondingly require but a single means to mount the same on the hub.

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

1. In an apparatus of the class described, the combination with a tube-holder adapted to carry a tube, of a rotatable hub adapted to support the tube-holder, and means to impart centrifugal motion to the hub, in both directions, alternately, said means consisting of a pair of cords adapted to be twisted in opposite directions on opposite sides of the rotatable hub.

2. The combination, with an axially-mounted rotatable body adapted to support a haematokrit-holder, of means to impart centrifugal motion, in opposite directions, alternately, to the rotatable body, said means consisting of a pair of cords mounted respectively at each of two opposite points on the periphery of the rotatable supporting-body.

3. The combination with a haematokrit-holder, of means to impart a centrifugal motion to the same, said means consisting of a rotatable holder in which the same is mounted, and means to impart centrifugal motion to the rotatable holder in opposite directions alternately, said means consisting of two pairs of cords twisted in reverse directions and mounted on said rotatable body in such manner as to actuate it from opposite peripheral points.

4. In an instrument of the class described, a substantially cylindrical hub adapted to support a tube-holder from either opposite end, and means to mount it, centrally of its length, on a pair of cords, intermediate of the length of the cords.

5. In an instrument of the class described, a substantially cylindrical rotatable hub, bored at its opposite ends, a pair of tube-holders supported in said ends of the hub, means to detachably maintain the tubes within the holders, said hub being bored transversely, and a pair of cords passing through the transverse openings in the rotatable hub.

6. In an instrument of the class described, an axially-mounted rotatable hub, with means to impart centrifugal motion to the same, a hollow tube-holder detachably supported in said rotatable hub, a washer and means to support it at one end of said tube-holder, and a closing-cap, carrying a washer, for the opposite end of said tube-holder.

7. In an instrument of the class described, a rotatable tube-supporting hub, means to impart centrifugal motion thereto, a hollow tube-holder adapted to be detachably supported on said hub and a washer with means to adjustably support the same within the tube-holder operating to support the tube therein and seal its open end when said elements are assembled in operative relation.

8. In an instrument of the class described, the combination of the following instrumentalities, namely, a rotatable tube-holder-supporting hub, means to impart centrifugal motion thereto, a substantially cylindrical hollow tube-holder carried by said rotatable hub, said tube-holder being fenestrated longitudinally and the edges of the fenestration forced slightly inward, and a test-tube having opposite segments converging to a line on its periphery, and adapted to be engaged by said edges of the fenestration when the tube and tube-holder are assembled in operative relation.

In testimony whereof I have hereunto affixed my signature this 29th day of July, A. D. 1904.

HENRY EMERSON WETHERILL.

Witnesses:
CHAS. M. MILLER,
A. M. BIDDLE.