No. 742,815. PATENTED OCT. 27, 1903.

T. L. VALERIUS.

CENTRIFUGAL MILK TESTER.

APPLICATION FILED MAY 18, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

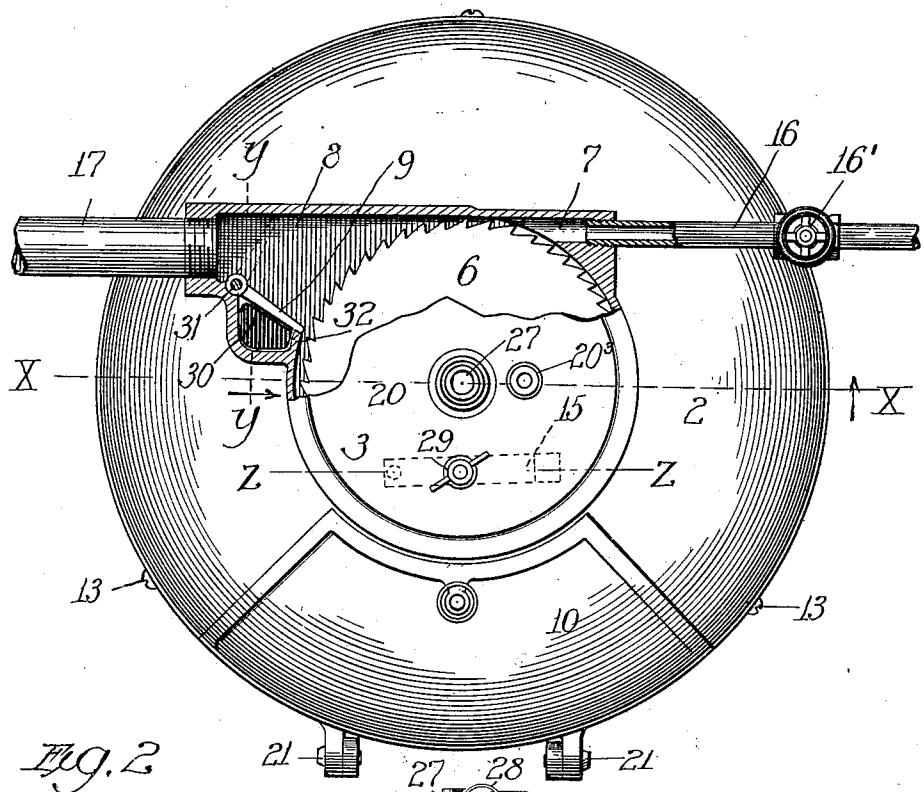
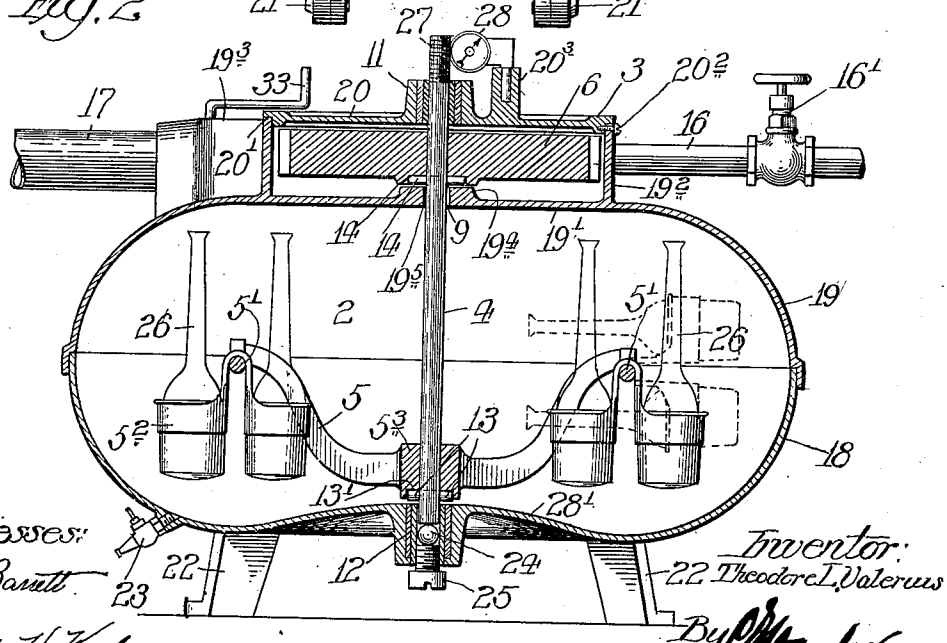


Fig. 2.



Witnesses:
H. J. Barrett
George H. Kelly

Inventor:
Theodore L. Valerius
By C. H. Crawley Atty.

No. 742,815. PATENTED OCT. 27, 1903.

T. L. VALERIUS.

CENTRIFUGAL MILK TESTER.

APPLICATION FILED MAY 18, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

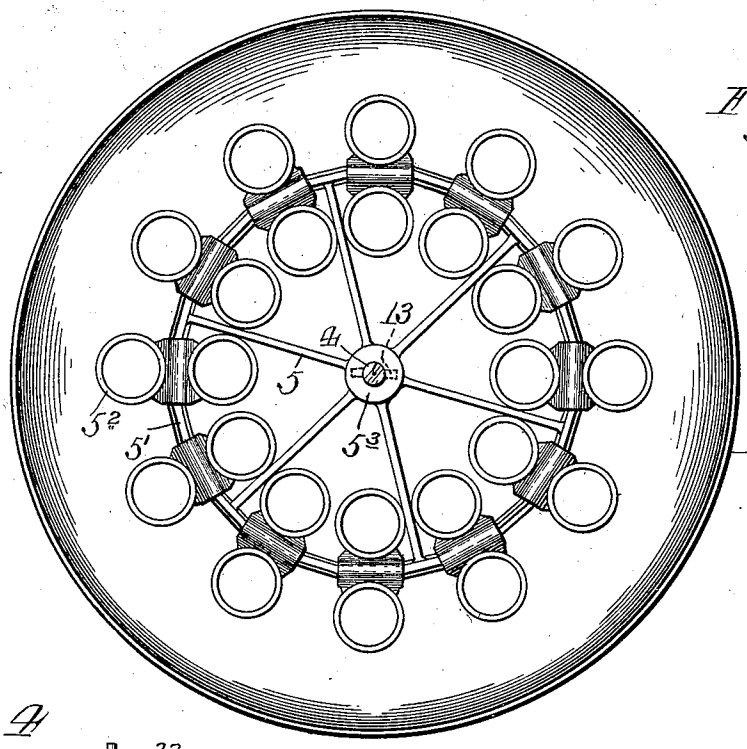


Fig. 4

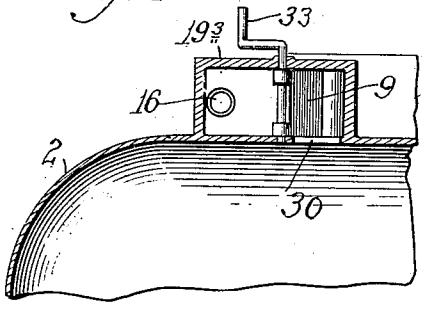


Fig. 7

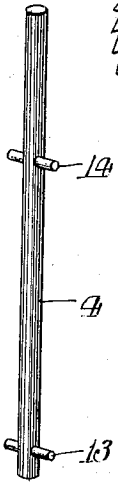


Fig. 6

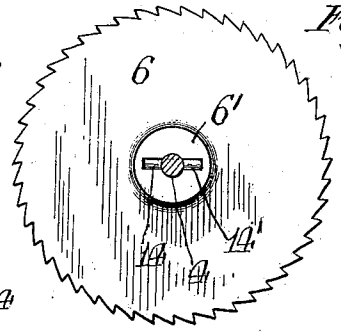


Fig. 5

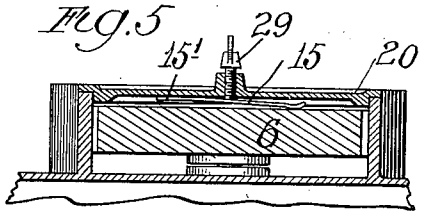
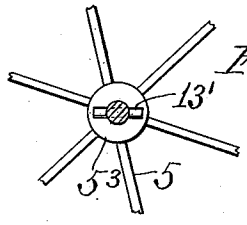


Fig. 8



Witnesses:

H. G. Barrett

Geo. H. Kelly

Inventor:

Theodor L. Valerius

By C. Brown Atty.

No. 742,815. Patented October 27, 1903.

UNITED STATES PATENT OFFICE.

THEODORE L. VALERIUS, OF FORT ATKINSON, WISCONSIN, ASSIGNOR TO CREAMERY PACKAGE MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CENTRIFUGAL MILK-TESTER.

SPECIFICATION forming part of Letters Patent No. 742,815, dated October 27, 1903.

Application filed May 18, 1903. Serial No. 157,680. (No model.)

To all whom it may concern:

Be it known that I, THEODORE L. VALERIUS, a citizen of the United States, residing at Fort Atkinson, in the county of Jefferson and State of Wisconsin, have invented a certain new, useful, and Improved Centrifugal Milk-Tester, of which the following is a specification.

My invention relates to centrifugal milk-testers of the class known as "Babcock" testers; and the invention has special reference to improvements upon steam-driven milk-testers.

The principal object of my invention is to provide a centrifugal milk-tester to be operated by steam and which will rotate the milk-test bottles at a higher speed than will other machines with less expenditure of steam and with steam at a lower pressure.

Another object of the invention is to provide a machine of this class whereby and wherein the temperature of the testing-bottles and their contents may be regulated, controlled, and, if need be, maintained with certainty, reliability, and ease.

Still another object of the invention is to provide means for quickly stopping the bottle-carrier of such a machine without waste of steam and for regulating the speed thereof when occasion requires.

The other objects of my invention are to provide a steam-driven or turbine milk-tester that shall be more durable than the machines hitherto devised and which shall also be of simpler, cheaper, and lighter construction.

My invention consists generally in a centrifugal milk-tester comprising a body that contains an upper and a lower chamber, in combination with a shaft extending through said chambers and having suitable bearings, a bottle-carrier arranged on said shaft within said lower chamber, and a steam-motor arranged on said shaft within said upper chamber, suitable means being provided for supplying steam to said motor; and, further, my invention consists, broadly, in a centrifugal tester having a bottle-carrier chamber and a steam-motor chamber, in combination with a valved connection between said chamber for exhausting a portion or all of the steam from said motor-chamber into said bottle-carrier chamber; and my invention further consists in a turbine-actuated centrifugal milk-tester comprising a suitable body, a steam-turbine, and a bottle-carrier connected therewith, in combination with positive mechanical means for stopping or braking the rotation of the turbine and carrier; and, further and specifically, my invention consists in the combination of a suitable body with a vertical shaft having widely-separated bearings therein and a steam-turbine and a bottle-carrier arranged on said shaft between said bearings. The invention consists also of various details of construction and of combinations of parts, all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a plan view of a centrifugal milk-tester embodying my invention, a portion of the top being broken away to show the steam-turbine and the temperature-controlling valve. Fig. 2 is a sectional view on the line $x\,x$ of Fig. 1. Fig. 3 is a plan view of the lower part of the machine containing the bottle-carrier, the upper half of the metal casing being removed. Fig. 4 is a sectional detail showing the temperature-controlling valve on the line $y\,y$ of Fig. 1. Fig. 5 is a section view on the line $z\,z$ of Fig. 1, illustrating the brake for stopping the machine. Fig. 6 is a view of the turbine-wheel from beneath. Fig. 7 is a perspective view of the shaft of the machine with the two coupling-pins thereon, and Fig. 8 is a detail view of the hub of the bottle-carrier as seen from beneath.

The noticeable or characterizing features of my machine are the large machine-body and the small motor-casing arranged on the top thereof. These contain the large lower chamber 2 and the small upper chamber 3, respectively. The vertical shaft 4 extends through both these chambers and is provided with bearings, preferably at its extreme ends, in the bottom and the top of said lower and upper chambers. A bottle-carrier 5 of any suitable

construction is attached to the shaft within the large chamber 2 of the body of the machine, being about as it is in other machines. The turbine-wheel 6, however, instead of being arranged in the same chamber with the bottle-carrier or in a chamber beneath the bottle-carrier is arranged above the bottle-carrier in the small upper chamber or casing 3. Said upper chamber is provided with a steam-inlet jet or nozzle 7. It also has an exhaust-steam cavity 8, and here occurs a further characterizing feature of my invention—to wit, the temperature-controlling device or valve 9 by which the passage of exhaust-steam from the motor-casing to the bottle-carrier chamber is controlled, as explained more fully hereinafter.

The other novel features of my machine which attract attention upon comparison with those now in use are the small door 10 for affording access to the bottle-carrier chamber without excessive exposure of its contents to cold air and quick changes of temperature, the simple widely-separated bearings 11 and 12 of the machine, with the long shaft, carrying the rotating parts between said bearings, the simple couplings 13 and 14 between the shaft and the bottle-carrier and the turbine-wheel enabling the quick assemblage or dismemberment of such parts, the mechanical positive brake 15, arranged, preferably, in the motor-casing and operable from the top thereof for stopping the rapidly-rotating members, the arrangement of the steam pipes or connections 16 and 17 at the top instead of at the bottom of the machine, and the elevation of the body of the machine above its bench or support, so that all parts of the machine may be easily cleaned and kept free from rust.

Referring now to the preferred detailed construction of my machine, as illustrated in the drawings, it will be observed that only four parts are required to make up the body or the frame of the machine—namely, the parts 18 and 19, constituting the upper and lower halves of the main body, the door 10 in said upper part, and the circular plate 20, which serves as the top of the motor-casing and contains the upper shaft-bearing 11. The meeting edges of the parts 18 and 19 are flanged and fitted to make a sufficiently-tight joint between them. Common screws are used for fastening them together, and when these are removed the parts may be easily separated. The door 10 is a sector of the curved upper part 19 and is preferably pivoted on the lower part 18 by the hinge-joints 21. The lower body part 18 is provided with legs 22, preferably integral therewith and which elevate the machine above its bench or support to permit the easy cleaning of all parts about the machine. The bottom 18′ of the part 18 is swelled upward or mounded to form a water-shed about the lower shaft-bearing 12 and whereby a drain-trough is formed in the bottom of the machine to collect spilled milk and water.

23 is a drain-cock for drawing off the liquid that accumulates in the bottom trough.

24 is a ball step-bearing supported by the screw 25 in the lower bearing 12. The bearings 11 and 12 are preferably brass collars or sleeves that are babbitted in the bosses on the bottom 18′ and on the plate 20, and the shaft is neatly fitted to said bearings to run smoothly therein.

The bottle-carrier 5 may be of any desired construction; but I prefer to use a light wheel, having a raised rim 5′ for carrying the swinging cups 5^2, wherein the test-bottles 26 are placed. The bottles are thus elevated above the bottom of the chamber 2, while the hub 5^3 of the bottle-carrier is placed low down in said chamber and is attached to the shaft 4 at a point close to the bearing 12. The shaft 4 is thereby relieved from excessive flexing strains. This is important, as the bottle-carrier is never accurately balanced when being used. The lower end of the carrier-hub 5^3 is provided with a cross-slot or recess 13′ to receive the cross-pin or coupling 13 in the shaft 4. The ends of the recess 13′ prevent the loss of the pin from the shaft; but said pin may be easily removed from the shaft when the carrier is lifted off the pin.

In all machines similar to mine the turbine-wheel has been placed upon the periphery of the bottle-carrier or in the base of the machine beneath the bottle-carrier chamber. Either of these constructions necessitates the employment of a wheel of large diameter, and it is obvious that the rotative speed of such a wheel must be less than that of a smaller wheel driven by a steam-jet of equal velocity. Hence to secure a higher rotative speed for the bottle-carrier I use a relatively small turbine-wheel 6 and find its most convenient location to be in the top of the machine instead of in the bottom, where its use would lead to an objectionable reduction in the size of the base of the machine and where the turbine would be difficult of access. The motor-casing of my machine is therefore much smaller than in other machines, and the weight of the machine as a whole is correspondingly reduced. The top 19′ of the body portion 19 forms the bottom of the motor-casing, which casing is completed by the vertical walls 19^2, the top 19^3 of the exhaust-cavity 8, all preferably integral with the part 19 and the circular top plate 20. The portion 19′ is provided with a boss 19^4, with a central opening 19^5 for the shaft 4. The boss 19^4 prevents the flow of water from the motor-casing, but is not a bearing, as I find that any bearing between the turbine and the bottle-carrier is objectionable, one reason being that an intermediate bearing would be difficult to get at and to lubricate. I therefore prefer the simple end bearings 11 and 12, though I do not confine the scope of my invention thereto. These bearings are easily attached and easily lubricated. The coupling between the shaft 4 and wheel 6 is like unto the coupling for

the bottle-carrier, comprising a pin 14, that is confined in a recess 14′ in the lower end of the wheel-hub 6′, at once preventing the rotation of the wheel on the shaft and supporting the weight of the wheel. The weight of the wheel, of the bottle-carrier, and of the shaft 4 is borne by the ball step-bearing 24, and the only frictional opposition to the rotation of the parts is the slight friction of the bearings 11 and 12. The top plate 20 is preferably provided with a turned shoulder 20′, neatly fitting the walls of the opening in the top of the motor-casing and making other steam-packing unnecessary. The plate is secured by screws 20^2 and may be easily removed when it is desired to inspect or take the turbine-wheel 6 from the casing. The upper end of the shaft 4 is preferably provided with a screw-thread 27, which coöperates with a simple speed-indicator 28, for which a post 20^3 is provided on the plate 20. The mechanical brake previously mentioned, comprising, preferably, a flat spring 15, is secured to the under side of the plate 20 at 15′, and a screw 29 is provided in the plate 20 for forcing the spring down against the top of the turbine-wheel 6. By this means the speed of the turbine-wheel and the bottle-carrier may be checked or the same stopped at will—a simple but important improvement over other testers, which must be stopped by reversing the steam-jet or else left to slowly run down after the steam is shut off. The motor-casing is provided with a straight side having the projections shown at its ends. The steam-jet 7 at one end is substantially tangential to the turbine-wheel. Steam is supplied through the pipe 16, which has a valve 16′ for regulating the flow of steam. The exhaust-pipe 17 leads out of the cavity 18, and between the same and the cylindrical walls of the casing I provide an opening or steam-passage 30 in the floor of the wheel-casing leading into the lower chamber. This passage is closed by the swinging valve 9, pivoted by the stem 31 and adapted to close against the end 32 of the cylindrical casing-wall. The upper end of the stem 31 is formed into a crank-arm 33, by which the valve may be opened and closed. The valve is so arranged that when swung to the opposite position it practically closes the direct passage to the exhaust-pipe, and all of the steam that enters the casing from the nozzle 7 will then pass down into the chamber 2. The swinging valve here shown may be held in any position to allow any portion of the steam to drive into the bottle-carrier chamber and is not likely to get out of order or to be difficult to operate. I therefore prefer to use a valve of this character in place of any of the numerous forms of valves that could be substituted for it without departing from my invention.

The operation of my centrifugal milk-tester is as follows: The milk to be tested is placed in the test-bottles and mixed with the test-acid, usually sulfuric acid. The door 6 of the machine is then opened and the bottles are placed in the swinging cups of the rotary bottle-carrier. The door is now closed, the brake 15 released, and the steam turned on at the valve 16′. The steam entering the turbine at a pressure approximating five pounds, many pounds less than with other testers, quickly starts the turbine-wheel and the bottle-carrier, which soon rise to a rotative speed, that, taken at the periphery of the bottle-carrier, will closely approximate the velocity of the steam at the nozzle. The rotation of the carrier causes the bottle-cups with the bottles therein to assume horizontal positions, and centrifugal force acting upon the ingredients of the milk, combined with the acid, according to their different specific gravities, quickly effects the separation of the butter-oil from the serum of the milk. The oil is displaced by the heavier serum and acid mixture and is driven inward into the small necks of the bottles. The valve 9 when in the position shown in Fig. 1 will be held shut by the pressure of the steam in the exhaust-cavity. The separation of the butter-fat in this manner requires but a few moments, at the end of which time the operator will close the valve 16′ and apply the brake to the turbine-wheel by turning down the thumb-screw 29. He may thus quickly stop the bottle-carrier, though at the moment of applying the brake it will have attained a high rate of speed. The operator then opens the machine and fills one bottle after the other with hot water to complete the test, the water serving to raise the oil in the neck of the bottle, where percentage can be read. After this the door is again closed and the bottles are again whirled for a few minutes to effect an absolute separation of the butter-oil and accumulate same in the graduated necks of the bottles. The readings from the bottles to be accurate must be taken while the bottles have a uniform temperature of about 150°, and the operator will therefore again close the machine and open the steam-valve 16′, meantime partially opening the valve 9. The turbine-wheel is at this time held by the brake, and the small quantity of steam that enters through the partially-opened valve 16′ will pass the turbine-wheel and be diverted by the open valve 9 into the opening 30 and the lower chamber. After the bottles have been heated the readings may be taken at once or the bottles may be kept at the required temperature indefinitely by a small quantity of steam, practically none of which will be permitted to escape at the exhaust because of the presence of the valve 9 across the exhaust-passage. The water of condensation and other moisture which accumulates in the bottom of the machine may be drawn off at any time by simply opening the cock 23.

When it is desired to dismember the machine, the bottle-carrier is lifted off the coupling-pin 13 and said pin is removed. The top

plate being then removed, the turbine-wheel and the shaft may be lifted out, and the bottle-carrier may then be taken out through the door. It is obvious that numerous modifications of my invention will readily suggest themselves to one skilled in the art, and I therefore do not confine my invention to the specific constructions herein shown and described.

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

1. A centrifugal tester, comprising upper and lower chambers, in combination, with a carrier for rotation in said lower chamber, and a carrier-driving device arranged in said upper chamber, substantially as described.

2. A centrifugal milk-tester, having a bottle-carrier chamber and a steam-turbine chamber or casing, a valved steam-supply for said turbine and a valved connection between said chambers for controlling the passage of steam from said turbine-casing to the bottle-carrier chamber, substantially as described.

3. A centrifugal milk-tester, having a steam-motor as one of its elements for driving its bottle-carrier and having communicating chambers in one of which said motor operates, in combination, with mechanical means for stopping said motor when it is desired to heat the other chamber, substantially as described.

4. A centrifugal tester, comprising upper and lower chambers or casings, in combination, with a shaft having end bearings, a bottle-carrier arranged on said shaft, in one of said chambers and a turbine-wheel arranged on said shaft, in the other chamber, substantially as described.

5. A centrifugal tester, comprising a suitable body, in combination, with a vertical shaft therein, having suitable bearings at its ends, and a motor-wheel and a bottle-carrier arranged on said shaft, between said bearings, substantially as described.

6. A centrifugal tester, having upper and lower chambers or casings, a vertical shaft arranged therein and having suitable bearings, a turbine-wheel secured to the shaft in said upper chamber, a bottle-carrier secured to the shaft in said lower chamber, and suitable inlet and exhaust connections for said upper chamber, substantially as described.

7. A centrifugal tester, comprising a body containing two chambers, one above the other, in combination with a vertical shaft having bearings in the top and bottom of said body, a bottle-carrier secured to said shaft at a point near one of its bearings, and a steam-turbine wheel secured to the shaft at a point near its other bearing, substantially as described.

8. A centrifugal tester, comprising a body containing a large bottle-carrier chamber and provided with a steam-turbine casing of less diameter than said chamber, a turbine-wheel provided in said casing, a bottle-carrier provided in said chamber, said carrier being of greater diameter than said wheel, and suitable means connecting said carrier and wheel, substantially as described.

9. A centrifugal tester, comprising a body portion containing a bottle-carrier chamber, in combination, with a turbine-casing upon the top of said body portion and of less diameter, suitable means for supplying and exhausting steam to and from said casing, a vertical shaft, a bottle-carrier thereon, within said body portion, a turbine-wheel on said shaft within said casing, and means connecting said wheel and carrier, substantially as described.

10. In a steam-turbine centrifugal tester, a turbine-wheel and a bottle-carrier, suitably connected and so constructed that the periphery of the bottle-carrier exceeds that of said wheel, when driven thereby, substantially as described.

11. In a centrifugal tester, the body, in combination, with a driven shaft having bearings in said body, a bottle-carrier, a supporting-coupling on said shaft between said bearings for said carrier and a supporting-bearing for said shaft, substantially as described.

12. In a machine of the class described, the combination, of the body containing upper and lower chambers, with a vertical shaft having suitable bearings, the steam-turbine wheel mounted on said shaft within said upper chamber, and a member to be driven, mounted on said shaft, within the lower chamber, substantially as described.

13. A centrifugal tester, comprising a suitable body, in combination with a vertical shaft, having bearings therein, including a bearing supporting said shaft against longitudinal movement, a steam-motor member mounted on said shaft and supported thereby, and a bottle-carrier mounted on said shaft and supported thereby, below said motor member, substantially as described.

14. A centrifugal tester, comprising a suitable body, in combination with a vertical shaft, a bottle-carrier arranged on said shaft, means for driving the shaft, the bottom of said body being provided with a water shed or mound, and a bearing provided therein and having a closed lower end, supporting said shaft and the carrier thereon, substantially as described.

15. In a centrifugal tester, the combination of a suitable body, having upper and lower vertical bearings, with a shaft arranged in said bearings and having an end support in one thereof, a cross-pin provided in said shaft and a rotary member mounted on the shaft and provided with a transverse bottom recess to receive said pin, whereby said member is supported on said shaft, to rotate therewith, substantially as described.

16. In a centrifugal tester, a body having upper and lower chambers, in combination, with a vertical shaft having supporting-bearings, a bottle-carrier in said lower chamber,

a turbine-wheel in said upper chamber, and cross-pins in said shaft, whereon said carrier and wheel rest, respectively, for rotation with the shaft, substantially as described.

17. In a centrifugal tester, a body containing a testing member, in combination, with a smaller steam-motor casing arranged on the top of said body, the motor member for operating the testing member, means for supplying steam thereto, an exhaust-cavity in said casing provided with an opening communicating with said body and a controlling-valve for regulating the flow of steam from said casing into said body through said opening, substantially as described.

18. A centrifugal tester, comprising a body containing two chambers, in combination, with a bottle-carrier arranged in one of said chambers, a steam-turbine wheel arranged in the other chamber, means connecting said wheel and carrier, a steam-nozzle entering the chamber containing said wheel, the exhaust-cavity of said chamber, an exhaust-pipe leading therefrom, a duct or opening connecting said chambers and a valve for partially or wholly closing the passage through said exhaust-pipe and diverting part or all of the steam through said duct or opening, into the other chamber, substantially as described.

19. In a centrifugal tester, a body containing a large lower chamber and a smaller upper chamber, separated by a common wall provided with a raised center within the upper chamber and having a central opening 19^5, in combination, with a shaft having bearings in the top and bottom of said upper and lower chambers respectively, a bottle-carrier provided on the lower end of said shaft, a motor member provided on the upper end of said shaft, within the upper chamber, and the steam inlet and exhaust connections of said upper chamber, substantially as described.

20. A centrifugal tester, comprising a body containing a turbine-chamber and a bottle-carrier chamber, in combination with rotary parts or members, a steam-inlet for said turbine-chamber, said turbine-chamber having an exhaust-cavity provided with a lateral opening, a swinging valve for closing said opening, and that portion of the exhaust-cavity behind said swinging valve being in communication with the bottle-carrier chamber, substantially as described.

21. A centrifugal tester, comprising a body made up of the upper and lower halves 18 and 19, in combination, with the sector-like door provided in said upper part and hinged on said lower part, the shaft within said body, the bottle-carrier provided thereon and means for driving said bottle-carrier, substantially as described.

22. The combination, of the body comprising upper and lower parts, together constituting the bottle-carrier chamber, with the turbine-casing provided on said upper part and substantially integral therewith, the circular top plate of said casing, suitable inlet and exhaust connections for said casing, the central shaft, the turbine-wheel, and the bottle-carrier, substantially as and for the purpose specified.

23. In a centrifugal tester, the combination of a shaft, with a bottle-carrier mounted thereon, a turbine-wheel on said shaft, mechanical means for stopping and regulating the speed of said wheel and means for at such time directing upon the bottle-carrier the steam that would otherwise be used by the turbine, substantially as described.

24. In a steam-turbine centrifugal tester, the combination of the chambered body with the turbine-wheel arranged in one of its chambers, a bottle-carrier provided in the other, said wheel and carrier being connected, the steam-nozzle of said turbine, a valved connection between said chambers, and a mechanical brake for stopping said wheel when said connection is opened, substantially as described.

In testimony whereof I have hereunto set my hand, this 6th day of May, 1903, at Fort Atkinson, Jefferson county, Wisconsin, in the presence of two witnesses.

THEODORE L. VALERIUS.

Witnesses:
FLORENCE WESCOTT,
ABBIE I. KYLE.