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CENTRIFUGE

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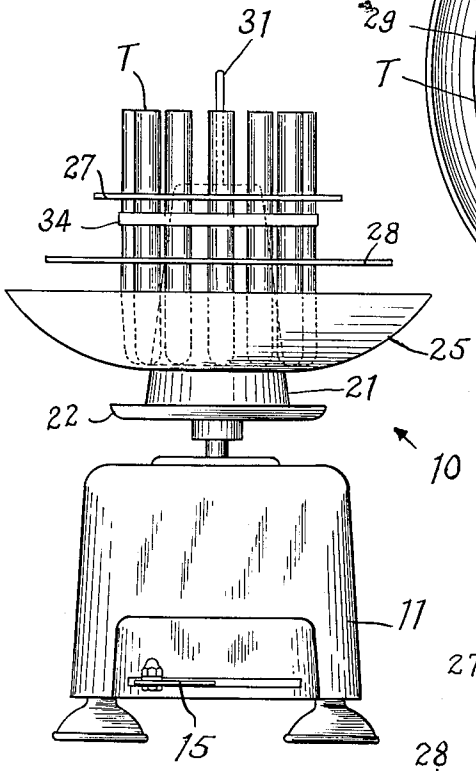


FIG. 1

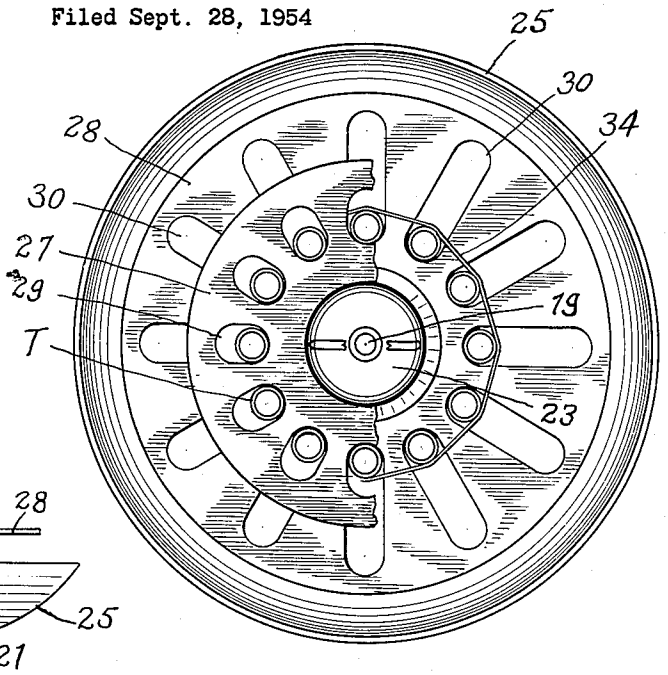


FIG. 3

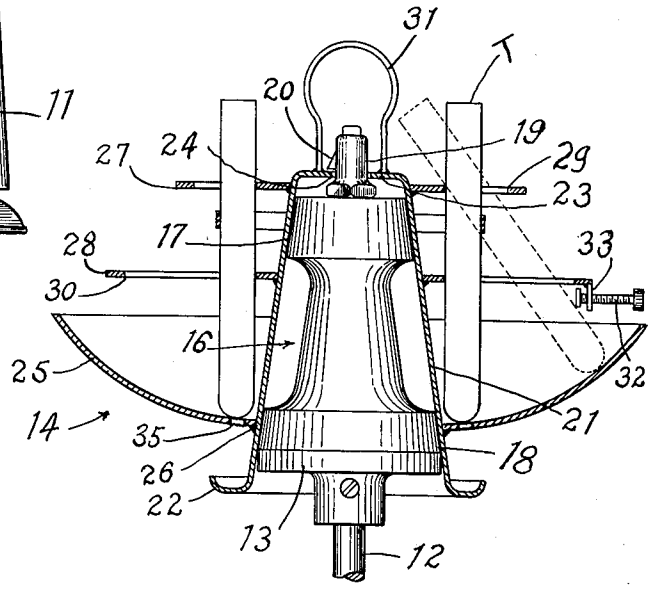


FIG. 2

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CENTRIFUGE

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9 Claims. (Cl. 233—26)

This invention relates to centrifuges. More particularly, the invention concerns centrifuges of general clinical and chemical application and which may be used for subjecting a variety of materials to centrifugal action for test purposes and the like.

In centrifuges known to the art, the holders for the sample tubes or containers are made unitary with the rotatable head. Such construction requires the sample tubes to be handled and carried individually and necessitating the use of separate racks for holding the tubes before they are placed in the centrifuge. The transfer of the tubes from rack to holder not only increases the required labor, but also impairs testing efficiency.

Accordingly, an object of this invention is to provide an improved centrifuge which includes a tube holder removably mounted on the rotatable head. Such a holder provides portable rack means for carrying the sample tubes, facilitating the preparation of the samples before centrifuging as well as the transportation and manipulation of the tubes after centrifuging.

Conventional centrifuges are provided with individual holders for the sample tubes, such holders being swingably mounted on arms or the like extending from the head. This type of construction requires many specially machined parts, articulation of the holders on the head, and otherwise involves the production of devices at a relatively high cost.

Another object of this invention is to provide an improved centrifuge having a unitary holder for a plurality of sample tubes, the holder being free of moving or articulated parts and being constructed to permit the tubes inserted therein in a vertical position to move outwardly towards the horizontal upon operation of the centrifuge, such holder including a minimum number of component parts in sheet metal form and being economical in the fabrication thereof.

A further object of this invention is to provide an improved centrifuge having a rotatable head on which is removably mounted a unitary holder for a plurality of sample tubes which are received in said holder in a vertical position, thereby permitting the holder to be used as a portable rack, the holder being constructed to permit the individual tubes to slide outwardly from their initial vertical position to approach the horizontal as the head is rotated.

Yet a further object of this invention is to provide an improved centrifuge including a holder of the character described wherein the same may be associated with an endless elastic band for encircling the sample tubes on the holder without interfering with the sliding movement of tubes as the centrifuge is operated, yet being effective to retain the tubes on the holder when the holder is removed from the head and inverted to remove the contents of the tubes or a portion thereof.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

In the drawing,

Fig. 1 is a front elevational view of a centrifuge embodying the invention;

Fig. 2 is an elevational view in section showing details of the holder thereof;

Fig. 3 is a top plan view thereof, with parts broken away.

Referring in detail to the drawing, and particularly to Fig. 1, **10** designates a centrifuge embodying the invention. The same comprises essentially a casing **11** which encloses an electric motor, not shown; the motor having a vertical shaft **12** projecting above the top of said casing with a head **13** fixed to the upper end of said shaft; and a portable holder for sample tubes T which are to be subjected to centrifugal action, the holder, generally indicated at **14** being arranged for driving engagement with head **13** and being removably mounted thereon.

At the lower end of casing **11** there projects from a horizontal slot in the casing, a laterally movable lever **15** which actuates a clock operated switch within the casing and in circuit with the motor for energizing said motor for a predetermined time interval. Such switches are well known in the art.

While the head secured to motor shaft **12** may have various shapes and forms, as shown in Fig. 2, the head **13** is of generally frusto-conical shape with an annular cutout as at **16** which leaves holder engaging surfaces **17, 18** at the upper and lower ends thereof respectively. A latch member **19** is fixed to the top of head **13**, the latch member including a spring pressed, depressable detent **20**, for the purpose hereinafter appearing.

The portable holder **14** comprises a hollow, elongated member **21** of frusto-conical shape, having an outwardly rolled flange **22** at the lower end thereof and a top wall **23** at the upper end thereof, the top wall being formed with a central opening **24**. A bowl shaped, thin metal member **25** is formed with a central opening **26** to receive member **21** projecting upwardly therethrough and secured to member **21** by soldering or the like at a point adjacent bottom flange **22**. Also fixed to member **21** are a pair of circular plates **27, 28**; the plate **27** being of lesser diameter and located adjacent top wall **23** of member **21** and the plate **28** being of greater diameter and located intermediate plate **27** and member **25**.

The top plate **27** is formed with a plurality of circumferentially spaced and radially extending short slots **29** while plate **28** is similarly formed with a plurality of elongated slots **30** which are aligned vertically with slots **29** in plate **27**. An inverted U-shaped handle member **31** is fixed to top wall **23** of holder member **21** to allow convenient transport of the holder to and from head **13**.

It will be apparent from a consideration of Fig. 2, that sample tubes T, whose contents such as blood specimens or the like, are to be subjected to centrifugal action, may be positioned on holder **14** by inserting the same in aligned pairs of slots **29, 30** in plates **27, 28**, with the bottoms of such tubes resting on the bottom of member **25**. The holder **14** may be supported on any suitable surface by means of bottom flange **22** while tubes T are placed in or removed from said holder and also serves as a convenient rack for such tubes, the rack being readily carried by means of handle **31**.

Assuming that sample tubes T on holder **14** have been filled with specimens to be centrifuged, then the holder is carried to head **13** and member **21** is slipped on to said head with the inner surface of member **21** engaging the surfaces **17, 18** on the head for driving engagement therewith, the latch member **19** passing through the opening **24** in top wall **25** of member **21**.

Upon moving switch lever **15**, the motor within casing **11** is adapted to be energized by means of a plug in cord inserted in an electrical receptacle, not shown, for a predetermined time interval. The rotation of holder **14**

will cause the sample tubes T to move radially outward from their rest position, indicated in solid lines in Fig. 2 to their inclined position shown in dotted lines in the same figure. It will be apparent that the slots **29**, **30** in plates **27**, **28** provide effective guide means for the radial movement of the tubes T while bowl shaped member **25** supports the bottoms of said tubes during their movement.

The extreme angle of inclination of tubes T upon rotation of head **13**, is determined by the effective length of slots **30** in plate **28** in relation to appropriate small variations in the length of slots **29** in plate **27**. The preferred angle of inclination for the tubes T may be adjustably determined by means of stop screws **32** threaded into small brackets **33** on the underside of plate **28**, the screws being radially aligned with slots **30** for radial movement to limit the movement of the tubes to desired positions.

The detent **20** on latch member **19** prevents undue upward movement of the holder **14** relative to head **13**, as when the head slows down after deenergization of the motor, or the like. The holder **14** is readily removed from the head by depressing the detent **20** to release the holder relative to the rotatable head.

It may be desirable to simultaneously move the tubes T, while they are still in holder **14**, to an inverted position, as for draining off washing solutions or the like. In such case, an elastic band **34** is placed in encircling relation to tubes T just below plate **27**. Such band will not interfere with the radial outward movement of the tubes during the centrifuging operation, but will be effective, after removal of the holder **14** from head **13**, to retain tubes T on the holder **14**, even when the same is inverted. Obviously, the elastic band **34** may be dispensed with if the tubes T do not require inversion.

The tubes T while positioned in holder **14** may have their contents heated if necessary by placing the holder in a water bath, drain holes **35** formed in bowl shaped member **25** allowing quick removal of the heating liquid as the holder is lifted from the bath by handle **31**.

It will be apparent that the device of the instant invention allows efficient centrifuging of the contents of tubes T which are free to move from rest to operative positions without strain on the tubes or the need for accessory holders for the tubes. The elimination of pivotal mountings and other special fittings, provides an economical construction for the holder which can be associated with selected rotatable heads for driving engagement therewith.

The portability of the holder **14** and its use as a rack for the sample tubes is of great importance in connection with testing procedures wherein preliminary sample preparation steps are necessary, as in blood tests, serology procedures and the like. Thus, the holder may be used in conjunction with a sample tube supporting board wherein the specimen tubes positioned on the board may be aligned with corresponding test tubes on the holder, and the test tube contents may be properly prepared for centrifuging. Thereafter, the holder is lifted from the board, located on the rotatable head for centrifuging, removed from the head and repositioned on the board for comparative purposes.

It will be apparent that there is disclosed herein a centrifuge in which the several objects of the invention are achieved and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the herein described invention without departing from the spirit thereof, it is understood that the matter herein set forth is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim as new and desire to protect by Letters Patent:

1. A centrifuge comprising a head mounted for rotation about a vertical axis, a holder mounted on said head

for carrying sample tubes arranged for radial movement relative to the rotational axis of said head upon rotation of said head, said holder comprising in combination, means for driving engagement with said head, means including curved wall portions for supporting the lower ends of said tubes throughout the extent of the radial movement thereof, and means for guiding the radial movement of said tubes upon rotation of said head.

2. A centrifuge comprising a head mounted for rotation about a vertical axis, a holder mounted on said head for carrying a plurality of sample tubes arranged in a circle, said holder comprising means for engaging said head and means rigidly and immovably secured to said first mentioned means for supporting said tubes in a vertical position adjacent the axis of rotation of said head while allowing said tubes to slide radially outward to positions inclined relative to the axis of rotation of said head upon rotation of said head, said second mentioned means comprising a pair of fixedly spaced members extending at right angles to the axis of rotation of said head, said pair of members being formed with a plurality of pairs of aligned slots for receiving said tubes and directing the movement thereof upon rotation of said head.

3. A centrifuge as in claim 2 wherein said second mentioned means further comprises a dish shaped member below said pair of members and fixedly related thereto for supporting the lower ends of said tubes passing through the slots in said pair of members.

4. A centrifuge comprising a head mounted for rotation about a vertical axis, a unitary holder mounted on said head for carrying a plurality of sample tubes arranged in a circle, said holder comprising a walled member for engaging said head, a pair of circular plates fixed to said walled member in spaced relation and extending at right angles to the rotational axis of said head, and a dished plate fixed to said walled member and spaced below the lowermost of said plates, said pair of plates being formed with pairs of radially extending aligned slots for receiving said tubes with the bottoms thereof resting on said dished plate, the slots in said plates being arranged to permit sliding outward movement of said tubes from an initial vertical position adjacent the rotational axis of said head to positions inclined relative to the rotational axis of said head.

5. A centrifuge as in claim 4 and further including stop means on said holder for adjustably determining the maximum angle of inclination of said tubes.

6. A centrifuge as in claim 4 and further including elastic means for engaging said tubes to prevent displacement of said tubes relative to said holder upon tilting or inverting said holder yet permitting sliding movement of said tubes relative to said holder upon rotation of said head.

7. A portable rack for a plurality of sample tubes comprising a hollow, walled member, a pair of spaced members fixed to said walled member and extending at right angles thereto, said pair of members being formed with a plurality of pairs of aligned slots, and a dished member fixed to said walled member beneath the lowermost of said pair of members.

8. A portable holder for elongated articles comprising a mounting member, guide means for said articles on said member, said guide means being formed with radially extending guide slots, and supporting means for said articles, said supporting means being located below said guide means and including curved wall portions for supporting the lower ends of said articles in any position thereof while upper portions of said articles are moved radially in the guide slots of said guide means.

9. A portable holder for a plurality of sample tubes to be subjected to centrifugal action comprising an elongated member, a pair of vertically spaced members fixed to said elongated member and extending at right angles thereto, said pair of members being formed with at least one pair of aligned slots of differential length, the

outer end of the slot in the lower of said pair of spaced members extending beyond the outer end of the slot in the upper of said pair of spaced members, and a dished member below the lowermost of said pair of members for supporting the lower ends of said tubes received in said slots while upper portions of said tubes move radially in said slots.

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