May 16, 1933. A. H. ADAMS 1,909,794

CENTRIFUGAL TREATING MACHINE

Filed April 13, 1928 2 Sheets-Sheet 1

Fig. 1.

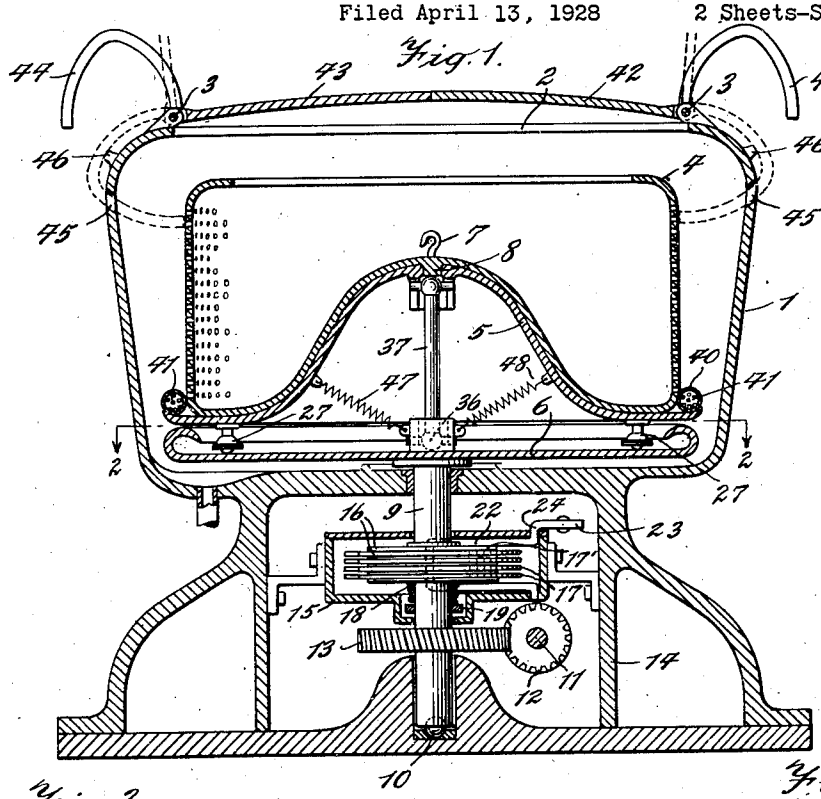


Fig. 3.

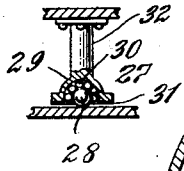
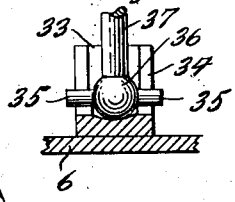


Fig. 5.



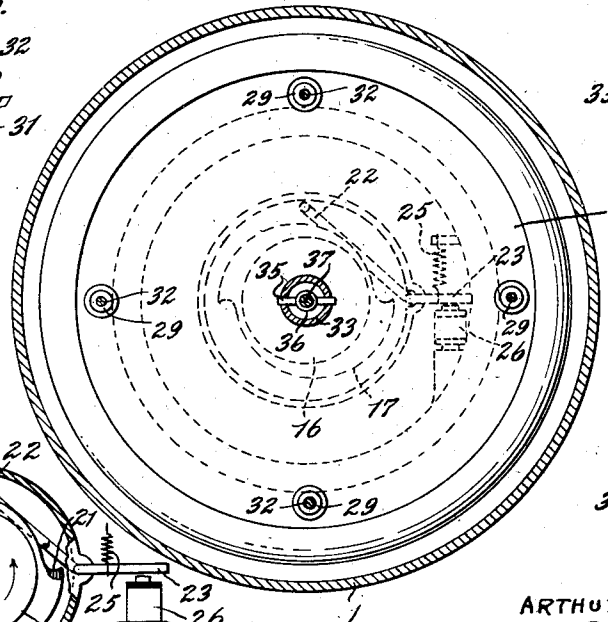


Fig. 2.

Fig. 4.

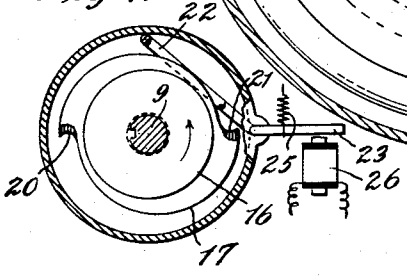
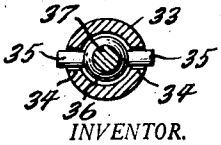


Fig. 5a



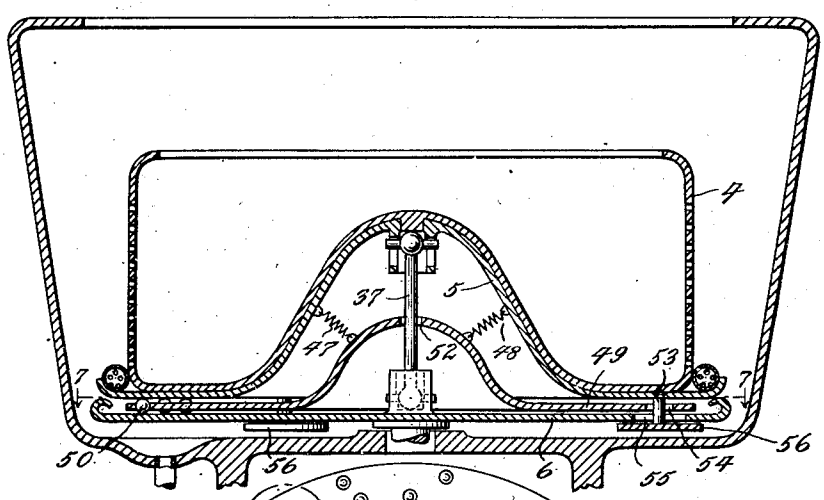
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CENTRIFUGAL TREATING MACHINE

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Fig. 6.



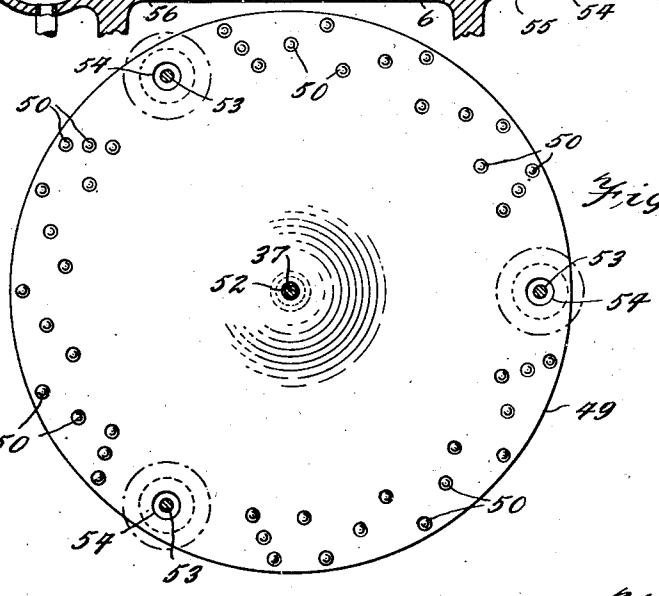


Fig. 7.

Fig. 9.

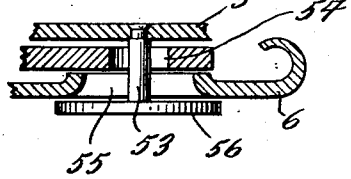
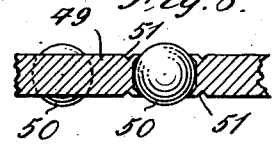


Fig. 8.



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Patented May 16, 1933 1,909,794

UNITED STATES PATENT OFFICE

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CENTRIFUGAL TREATING MACHINE

Application filed April 13, 1928. Serial No. 269,851.

This invention relates to centrifugal treating machines, and in particular to extractors.

In machines of the above-noted character various arrangements have been proposed for overcoming the deleterious effects due to centrifugal unbalance. For example, in one type of extractor, i. e., the overdriven type, the extractor basket is attached to the lower end of a relatively long vertical shaft which, with the supports for the upper bearing and drive, interfere materially with the charging of the basket with materials and also makes this construction costly. In this construction gravity tends to bring the shaft to a true vertical and the basket is usually rigidly attached to the shaft, or is otherwise so mounted that a displacement of the shaft from the vertical will tip the basket. When therefore the basket is unbalanced by the load and the driving torsion is applied, the tendency of the mass to revolve about the center of gravity causes the shaft and basket to swing out of the central position, tipping the basket. This tipping gives rise to strong precessional movements, resulting in the lapse of considerable time before the center of mass is stationary and the consumption of much energy in oscillations, friction and vibration, which energy would otherwise be available for acceleration of the centrifugal extraction of liquids.

If the basket with its load is really symmetrical with respect to the driving shaft, and assuming the latter to be started somewhat out of its central or vertical position, the application of a torque to the shaft will only result in what may be called a normal precession of the shaft axis and of the basket. If, however, the basket is unbalanced, i. e. if its center of mass does not coincide with the geometrical center of the shaft which is the usual case, this precessional motion of the shaft axis will be irregular and will vary within wide limits, especially while the basket is coming up to speed. This irregular precessional motion appears in the form of undesirable vibration of the basket, which may cause the basket to strike the guard or curb and it may even be so violent as to be dangerous to attendants.

In accordance with the present invention this undesired precessional vibration is avoided by allowing the basket automatically and speedily to assume, without restraint, a position in which it may rotate freely about the vertical axis through its center of mass. Further, all precessional motion is made impossible by confining the movement of each particle of the rotating mass to a plane normal to that axis.

The principal object of the invention is to provide a centrifugal treating machine preferably of the underdriven type in which the effects of unbalance and of incorrect starting position, are reduced to a minimum.

Another object is to provide a centrifugal treating machine wherein the rotating element is laterally unrestrained and therefore free automatically to assume a position of free rotation about an axis through its center of mass, whereby it is confined to motion in a plane and not subject to precessional disturbances.

Another object is to provide a centrifugal treating machine having means for applying substantially pure torque to the rotating element.

A further object resides in a basket for a centrifugal machine which is mounted for substantially unrestrained motion in a horizontal plane.

A feature of the invention pertains to the manner of coupling a rotating element with a driving shaft, whereby said element is capable of unrestrained movement in a plane at right angles to the said shaft.

Another feature resides in the combination of a rotating platform with an extractor basket mounted on, and adapted to rotate at the same angular velocity with said platform and is also capable of simultaneous lateral movement on said platform with a minimum of friction.

A further feature resides in a modified form of universal coupling for transmitting substantially pure torque to an extractor basket.

A further feature of the invention relates to novel means for centrifugally balancing a rotating element.

A still further feature is concerned with cover-controlled means for centering an extractor basket with respect to a driving shaft.

And finally, the invention contemplates the provision of a novel form of snatch-brake which is particularly well suited for laundry machines, such as extractors and the like.

Other features and advantages of the invention which have not been specifically enumerated will become apparent after a consideration of the following detailed description and the appended claims.

While it has been chosen to disclose the inventive idea in connection with a centrifugal machine of specific construction, suitable for use as a laundry extractor, it is understood that this is merely for the purpose of description in order that a clear understanding may be attained of one particular mode of practising the invention, and applications to other types of machines are within the compass of the invention.

Referring to the drawings Fig. 1 shows a view in sectional elevation of a machine embodying the various features of the invention.

Fig. 2 shows a horizontal section of a part of the machine of Fig. 1, the section being taken along line 2—2 of Fig. 1.

Fig. 3 is a detail view of one of the basket supporting members.

Fig. 4 is a detail view of a brake constructed according to the invention.

Figs. 5 and 5*a* are detail views of one of the pin-slot universal coupling members.

Fig. 6 is a vertical section showing another embodiment of the invention employing an alternative form of anti-frictional basket support.

Fig. 7 is a detail plan view of the anti-frictional basket supporting member shown in the embodiment of Fig. 6.

Fig. 8 is a detail section of the member shown in Fig. 7.

Fig. 9 is a detail section illustrating the relation between the driving platform and the frictionless support of Fig. 6 and showing particularly a means to restrain the basket carrier 5 against vertical movement while allowing ample freedom in one plane.

The machine in connection with which it has been chosen to illustrate the invention is generically known as a centrifugal extractor and comprises a curb or outer casing 1 (Fig. 1) having a top opening 2 adapted to be closed when the machine is in operation by a suitable cover preferably divided in half and hinged at opposite sides of the curb as represented by the numerals 3, for purposes hereinafter described. The lower portion of the curb is in the form of a hollow pedestal and serves as a housing for the driving gears, clutch mechanism and other portions of the machine. The opening 2 in the curb is preferably sufficiently large to permit the extractor basket 4 to be raised and lowered on to the carrier 5. As shown in Fig. 1 the basket has a reentrant central portion of the same general shape as, and adapted to fit over, the carrier 5 which is anti-frictionally mounted upon the rotating platform 6, as hereinafter described. The carrier 5 may either be of a solid or skeleton-like heavy casting or of formed sheet metal and if desired may have its central reentrant portion weighted, in order without greatly increasing the moment of inertia, to increase the ratio between the mass of the charge as compared with the mass of the rotating carrier and basket for purposes hereinafter described. The reentrant portion of the basket 4 is unperforated while the side walls are copiously perforated for the ejection of liquid or other extract thrown from the materials under treatment. As indicated by the numeral 7 the basket is provided at its center with a hook or its equivalent, by means of which the basket may readily be raised and lowered on to the carrier 5. This feature of having the basket removable is highly desirable in machines that are employed as laundry driers, since it permits the basket to be transported on overhead conveyers or the like and the attendant may more evenly distribute the load in the basket while it is suspended by the hook 7 outside the curb at the appropriate loading station. Any form of coupling may be provided between the carrier 5 and the basket 4. For example, the raised central portion of the carrier 5 may be provided with a square hole which registers with a corresponding square projection 8 on the center of the basket.

The carrier 5 which supports the entire weight of the charged basket is anti-frictionally mounted on a true flat metal platform 6 which has its edge turned back upon itself to form a trough-like structure for the retention of a layer of oil or other lubricant and also acts as a ring for preventing the extracted liquid from gaining access to the platform proper. Platform 6 is secured to shaft 9 for rotation therewith, said shaft being provided at its lower extremity with a suitable non-frictional step-bearing represented schematically by the numeral 10. It will be understood that platform 6 must preferably spin in a quite truly horizontal plane. For this purpose it may be desirable to provide adjustable connections between shaft 9 and platform 6, whereby the said platform may be permanently and accurately fastened to enable it to rotate in a true horizontal plane.

The numeral 11 represents the motor driving shaft which transmits its power to shaft 9 through helical gears 12 and 13. Suitably supported on the interior of the hollow pedestal portion 14 of the curb is a box 15 which encloses a braking mechanism for shaft

9. This brake comprises alternate circular discs 16 which are splined to shaft 9, and discs 17 which loosely engage said shaft. Between these sets of discs 16 and 17 are thin sheets of friction material 17'. The pressure between the discs and consequently their friction may be regulated by suitable adjusting means schematically represented by the compression spring 18 and the adjusting nut 19. As shown clearly in Fig. 4, the discs 17 have a cam shaped periphery with diametrically disposed notches 20, 21, cooperating with a U-shaped swingable frame 22 which can positively latch the discs 17 against rotation. Frame 22 is mounted for rotation toward and away from the discs 17 in suitable bearings in the top and bottom of the box 15. For the purpose of rotating frame 22 there is provided a lever 23 which is secured to the upwardly extended end 24 of the frame. The frame 22 may be normally held in engagement with the discs 17 by any suitable means, for example, by a spring 25 attached at one end to the lever 23, the other end being anchored in any convenient manner to the curb. The frame 22 may be uncoupled from the discs by any suitable means, for example, by an electromagnet or solenoid 26 adapted when energized to rotate frame 22 from engagement with the discs 17 against the tension of spring 25. As shown, the notches 20, 21, are preferably slightly hook-shaped so that there is a positive gripping action on the discs as soon as the frame 22 engages therewith. Because of the blows caused by the sudden stopping of discs 17 by their projections 20, 30, engaging frame 22, these projections are preferably reinforced and especially hardened to be capable of withstanding these shocks. The blows are sharp but their energy is less than might appear as discs 17 are thin and light.

As shown clearly in Fig. 1, the entire weight of the basket 4 and carrier 5 is antifrictionally supported on platform 6, preferably at diametrically opposite points on ball-bearing casters 27, or the like, one of which is shown in detail in Fig. 3. Each caster (Fig. 3) comprises a spherical bearing member 28 which rotates in the housing 29 and is backed by balls 30 which are enclosed by the cover 31 through which the member 28 protrudes. The leg 32 which is preferably formed integral with the housing 29 is fastened by appropriate means, as by rivets, to the bottom of the carrier 5. Thus, carrier 5 and the charged basket 4 being anti-frictionally supported are free to move in any direction on the platform 6.

For the purpose of transmitting the rotary motion of shaft 9 to the basket 4 without interfering with the free translational movement of said basket on the platform 6, that is to say, by applying a substantially pure torque to the basket, there is provided a novel form of an extensible shaft having universal connections at opposite ends with the platform 6 and the carrier 5 so that said carrier 5 is free to move relative to the platform 4 at the same time that it is being rotated. For this purpose the platform 6 is coupled to the carrier 5 by universal coupling members, one of which is shown in detail in Figs. 5 and 5*a*. This coupling member comprises a hollow cylindrical member 33 having two slots 34 at opposite sides thereof, which are adapted to receive pins 35 formed integrally with the spherical end 36 of the member 37. The slots 34 in the member 33 are sufficiently long to permit the member 37 to move freely in a vertical direction. Due to the length of the slots 34 which engage the pins 36 as well as the ball and socket arrangement between the end 36 and member 33, the member 37 is capable, during rotation, of universal movement with respect to the member 33. A similar universal coupling is provided between the upper end of the member 37 and carrier 5. By means of this universal coupling at both ends of the shaft 37, when the platform 6 is rotated a corresponding angular velocity is transmitted to the carrier 5 and the loaded basket 4 through the shaft 37, which is free to assume substantially any angular position with relation to the driving shaft 9. In other words, pure torque may be transmitted from the shaft 9 to the carrier 5 regardless of the position of the said carrier and basket on the platform 6. It is obvious therefore that should the load in the basket 4 be unevenly distributed, whereby the center of mass of the rotating system as a whole is displaced laterally with respect to the center of shaft 9, because of the anti-frictional mounting of the carrier and basket and because of the universal coupling between the platform 6 and the carrier 5 the drum is enabled to start rotation at once about some vertical axis without any substantial restraint, and the position of this vertical axis is determined by the location of the center of the mass at the time of applying torque. This results from the fact that the member 37, while it is capable of transmitting torque to the loaded basket and of rotationally accelerating the mass is capable of exerting a lateral or translation force on the mass. Thus, the charged basket is free, within certain wide limits, to spin about any point on the platform 6 when it is being rotated by the member 37. In this connection it will be noted that the entire weight of the carrier and loaded basket is borne entirely by the anti-friction members 27 and not by the universal coupling members.

For the purpose of automatically reducing the eccentricity between the center of mass of the system comprising the rotating basket and carrier, and the geometrical center of said system, the carrier 5 is provided with a

novel form of centrifugal balancing arrangement comprising an annular pipe or tube 40 fastened to the outer rim of the carrier 5 in any suitable manner. The tube 40 contains a quantity of flowable material preferably of a heavy character such as mercury, mercury amalgam, steel balls, or the like. Consequently, if the center of mass of the charged basket is eccentric, the flow of material in the tube 40, due to centrifugal force, will tend to move it the greatest possible distance from the center of mass of the rotating system. For example, if the basket 4 shown in Fig. 1, is so loaded that the center of mass is displaced to the right, then it will start rotating about this center of mass and the portion of the basket and of pipe 40 that was initially at the left, will be at a greater distance from the center of rotation than any other side. Consequently, the material in tube 40 will tend to accumulate in this initially left-hand portion thereof, which, in effect, causes a gradual displacement of the center of mass of the entire system toward the left until the eccentricity is a minimum. This, of course, does not shift, relative to the earth, the position of the center that the mass spins about. The quantity of material in the tube 40 and the size of said tube may be so designed that the maximum displacement of the center of mass of the rotating system as found in practice may be very nearly counterbalanced. For the purpose of causing the material in tube 40 to move steadily and not too violently toward the unbalanced side of the rotating system, that is, to prevent surges in the flow of material due to acceleration of the basket and carrier and to prevent sudden changes in the center of mass of the system, the interior of the tube 40, as indicated by the numeral 41, is provided at various points with baffle plates, gratings, perforated plates, or the like, for the purpose of dampening out such surges of the column of flowing material.

A typical operation of the machine is as follows:

The basket 4 having been previously removed by suitable conveying mechanism preferably of the overhead trolley type is charged as evenly as possible. For this purpose special balancing means may be provided if desired, or it may be loaded or readjusted while suspended in order that the attendant may most accurately distribute the material uniformly about the geometric center of the basket. When the basket has been thus charged it is conveyed from the charging location to the extractor and lowered through the opening 2, and rotated by hand until the projection 8 of the basket registers with the corresponding hole in the carrier 5. The attendant thereupon closes both halves 42 and 43 of the curb cover. In this connection it will be noted that every time the covers are opened the basket is mechanically centered within the curb. This is effected through the intermediary of the centering fingers 44, which move in unison with the respective cover members 42 and 43. When the covers are closed fingers 44 assume the positions shown in full lines in Fig. 1. As the covers are raised the fingers move through corresponding openings 45 in the side of the curb until said fingers engage the sides of the basket 4, as represented by the dotted line positions. Suitable stops 46 are provided to limit the inward movement of the fingers 44 in which position the basket is accurately centered on the platform 6. While only two centering fingers at diametrically opposite points are shown, it will be understood that two or more may be provided for each half of the cover, the essential thing being that the raising and lowering of the cover causes the basket to be pushed to the center of platform 6. If an electric motor is used, the switch for turning on the motor at the same time energizes the solenoid 26 whereby the frame 22 is drawn out of engagement with the clutch discs 17 which are thereupon free to rotate with the shaft 9 which in turn rotates the platform 6. When shaft 9 rotates a torque is transmitted through the member 37 to the basket and carrier which are therefore constrained to rotate at the same angular velocity as the shaft 9. If the basket is accurately balanced initially, and since it started geometrically centered over the center of shaft 9, it is obvious that the center of the mass will be substantially in line with the axis of the shaft 9. Consequently when torque is transmitted through the member 37 the platform 5 with the basket 4 will find its natural center of rotation to be substantially in line with shaft 9 and will rotate resting on the platform 6 without any motion relative to said platform. The material in the tube 40 will have been symmetrically distributed in the tube by gravity and will not shift. Should, however, the basket be somewhat unbalanced initially the center of mass of the rotating system is eccentric with relation to the axis of shaft 9 and the basket will instantly start rotating about the center of mass. This will have the effect of causing every point of the basket and carrier and the anti-friction supporting members 27 (Fig. 3), in particular, to describe circles over the surface of platform 6. These circles will all have the same radius and this radius will be equal to the displacement of the center of mass from the center of the machine. The action will be much like that of rubbing the two hands together with a simultaneous circular movement.

Due to the balancing effect of the material in tube 40, the eccentricity of the center of mass in the basket is progressively decreased by the material in said tube tending to move

in a direction opposite to the displacement of the center of mass. Since the basket and carrier form a closed system incapable of receiving any translational force, this will not, as might at first be supposed, bring the center of mass any nearer the axis of shaft 9, but merely reduces the eccentricity of the basket.

Of course the optimum counterbalancing condition would be attained if the material in tube 40 could entirely counterbalance the unbalanced load and if the center of mass could thus be brought absolutely to coincide with the center of the basket.

Further, it is desirable that the final center of mass (and of rotation) of the basket, even though to one side of the geometric center of the basket, should be brought to the center of the machine. For in this condition the (hand rubbing) movement of the support 5 and of the basket relative to platform 6 will cease entirely. While the center of mass, because of the lack of all constraint, will not be driven farther from the center of the machine by centrifugal force, there are only very weak forces (such as the greater air pressure on the basket at any side where it runs nearer the curb) to impel it to the machine center. A slight tilt of platform 6 might cause gravity to overcome this air force. Hence, it has been found advisable to supply a set of light centering springs 47, 48, weakly tending to locate carrier 5 with its center over the axis of shaft 9. These should be relatively weak in order not to provide sufficient lateral constraint to the self-centering action of the basket to cause it to develop appreciable centrifugal force. It is clear that, were these springs strong, they would hold the geometric center of the basket on the machine center, regardless of the position of the center of mass. The universal jointed coupling member 37 would still force the basket to spin, but, the center of mass of the basket would be forced to revolve (relative to the earth) about the center of the machine, instead of remaining stationary (relative to the earth) as through inertia it tends to do, and as it is the great advantage of this invention to permit it to do. A set of light springs, especially if connected, as shown on a slant, will not give restraint enough to compel the center of mass to revolve and yet will slowly draw basket and carrier 5 as near as possible to their centering on the machine center. When the center of mass of the basket is over the machine center these springs are as nearly satisfied as possible and no further relative movement will occur between carrier 5 and support 6.

After the extraction is completed, the motive power is turned off causing a deenergization of the solenoid 26 and a retraction of the frame 22 into engagement with the clutch discs 17. The frame 22 thereupon grips the next set of projections 21, for example, and positively prevents further rotation of the driving discs 17. The shaft 9 is therefore subjected to a continuous braking action.

While a specific form of extensible universal coupling is provided between the carrier 5 and the platform 6, it will be obvious that any other form may be employed. For example, instead of relying upon the slots 34 for permitting the lateral movement of the basket, the shaft 37 may be of the telescoping kind and well known forms of universal couplings may be provided between the two ends of the telescoping shaft and the support 5 and platform 6 respectively.

Referring to Fig. 6, there is shown another modification of the invention in which the basket 4 instead of being mounted on ball-bearing casters is mounted on a ball bearing thrust ring comprising a circular sheet of metal 49 (Fig. 8) having a series of balls 50, rotatably mounted in corresponding perforations in the plate 49. Any well known manner of mounting the balls in the plate, to enable the balls to freely move without dislodgment, may be employed. For example, the surfaces of the plate may be punched, as indicated by the numeral 51, to retain the balls therein.

As shown in Fig. 6, the carrier 5 is coupled to the rotating platform 6 by an extensible universal coupling member 37 so that when member 37 is moved angularly with respect to the driving shaft 9, the plate 49 also moves to correspond, but to just half the extent. This would be the natural movement of plate 49 if carried by the perfect rolling of balls 48. This coupling of plate 49 to member 37 at one-half the height of the latter serves to counteract any tendency of the latter to slip or creep.

For the purpose of limiting any possible vertical displacement of the basket 4, the same is provided with downwardly projecting pins 53 (Fig. 9) which pass through relatively large openings 54 and 55 in the members 49 and 6 respectively. The pins 53 carry at their lower ends members 56 which are larger than the openings 55 so that the vertical movement of carrier 5 is limited. Since basket 4 and platform 6 rotate with the same velocity, this limiting arrangement does not interfere with the free movement of the basket on the platform. It will be understood that the platform 6 has its upper surface covered with a thin layer of oil for reducing the friction between the member 49 and the said platform. The remaining parts of the machine shown in Fig. 6 may be similar to those disclosed in connection with Fig. 1 and it is believed that the operation of this embodiment of the machine will be understood from the description given hereinabove. In this connection it is to be noted that the

embodiment shown in Figs. 1 and 2 also may be provided with members similar to members 53, 55, for the purpose of limiting the vertical movement of the basket and carrier with respect to the platform 6.

While specific apparatus has been disclosed for illustrating the character of the invention, it will be understood that changes may be made without departing from the spirit thereof, the essence of the invention residing in a centrifugal treating machine having a basket or container which is substantially free to revolve about its center of mass without undesirable vibration.

What I claim is:

1. In combination, a rotatable member rotatable about an axis, a relatively light brake member frictionally coupled to said rotatable member, a projection on the brake member, means comprising a latching device for engaging said projection and stopping said brake member, a spring for moving said latch into engaging position with respect to said brake member, and releasable means for counteracting the spring and maintaining the latch out of engaging position.

2. In combination, a rotatable member rotatable about an axis, a relatively light brake member frictionally coupled to said rotatable member, a projection on the brake member, means comprising a latching device for engaging said projection and stopping said brake member, means for normally tending to move said latch into engaging position with respect to said brake member, and manually controlled means for counteracting said means and maintaining the latch out of engaging position.

In testimony whereof, I have signed my name to this specification this 9th day of April 1928.

ARTHUR H. ADAMS.