Aug. 14, 1934. C. L. HEISLER, JR 1,970,377

CENTRIFUGAL MACHINE

Filed Jan. 28, 1933

Fig. 1.

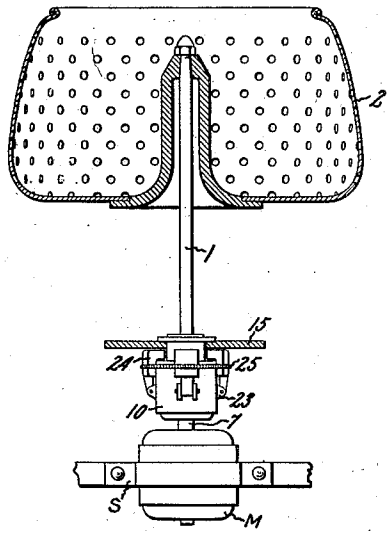
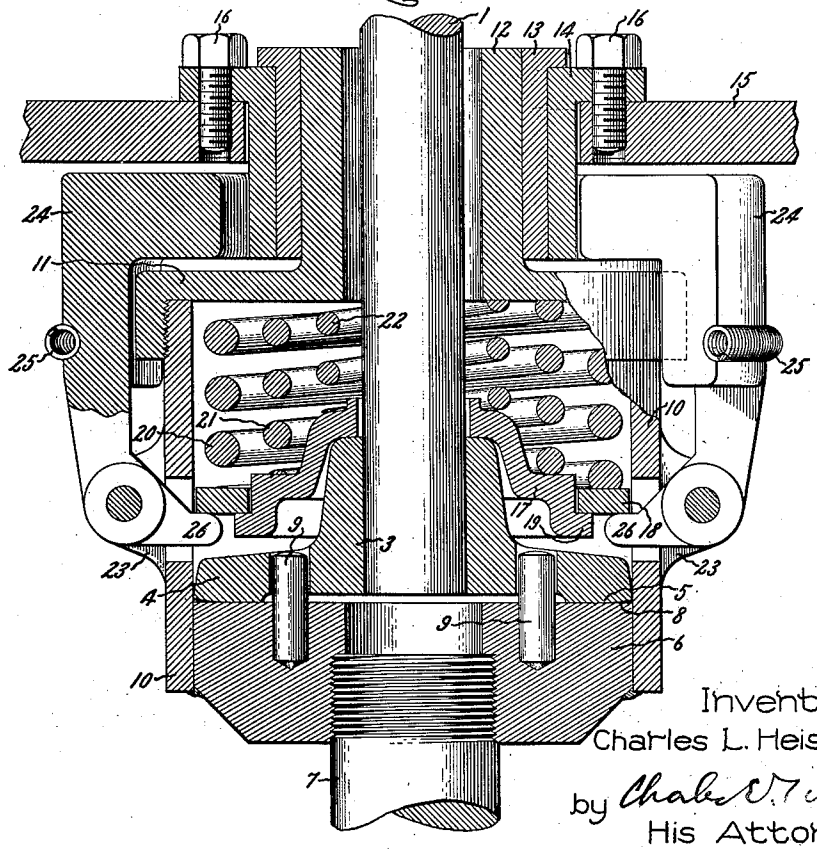


Fig. 2.



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CENTRIFUGAL MACHINE

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11 Claims. (Cl. 210—71)

The present invention relates to centrifugal machines such as centrifugal dryers, centrifugal extractors, and the like which comprise a shaft, usually a vertical shaft, driven at one end and driving a device, such as a basket or receptacle, for example, at the other end, the device being supported usually by the shaft. When the load rotated by such a shaft is not in balance, the shaft tends to rotate with a whirling motion, that is, to rotate about an axis other than its normal geometric axis, especially at or in the vicinity of the critical speed of the structure and since ordinarily such devices are operated at speeds above the first critical speed, it is necessary to pass through the critical speed in starting up and in stopping.

The object of the present invention is to provide an improved construction and arrangement whereby difficulty in passing through critical speed is minimized or entirely avoided, and for a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a view of a structure embodying my invention, and Fig. 2 is a sectional view on a large scale of a part of the mechanism.

According to my invention, I provide in connection with a rotating structure of the character referred to above, a means for changing the critical speed of the structure, i. e., changing it from a higher value to a lower value when starting up and the speed is increasing, and from a lower value to a higher value when stopping and the speed is decreasing. The arrangement is such preferably that the critical speed is changed abruptly or quickly and by a considerable amount so that when the speed of the structure is being increased and is approaching the then critical speed of the structure, the critical speed of the structure will be changed abruptly or quickly to a value below its then operating speed; and similarly when the speed is being decreased and is approaching the then critical speed of the structure, the critical speed of the structure will be abruptly increased to a value above the then operating speed. By this arrangement, the structure operates only momentarily at either critical speed, passing through the critical speeds very quickly.

Referring to the drawing, 1 indicates a vertical shaft which is driven at its lower end and supports a receptacle 2 at its upper end which may carry an unbalanced load. Receptacle 2 may be the basket of a centrifugal dryer such as is used in the drying of clothes, for example. Fixed to the lower end of shaft 1 is a hub 3 provided with a flange or collar 4. The under side of collar 4 adjacent to its periphery is provided with an annular foot 5 which rests on the upper flat surface of a collar 6 mounted on a driving shaft 7. With this arrangement, collar 4 engages collar 6 only at its periphery. The under surface foot 5 is rounded slightly as is indicated at 8 so that collar 4 can rock on collar 6. Shaft 7 may be supported by a suitable thrust bearing (not shown) and driven in any suitable way, for example, by an electric motor M carried by a suitable support S.

Collars 4 and 6 are locked together by pins 9 which are fixed to collar 6 and project into openings in collar 4, the openings being somewhat larger than the pins to permit of flexing or rocking collar 4 on its rounded foot.

Fixed to collar 6 is a housing comprising a side wall 10 and a top wall 11, the top wall being provided with an opening surrounded by a bearing sleeve 12 through which shaft 1 projects. Bearing sleeve 12 turns on a bearing lining 13 carried by a flanged support 14 which is attached to a fixed support 15 by studs 16. Support 15 may be, for example, the supporting frame of a clothes washing and drying machine.

Resting on hub 3 is a spring support comprising two parts, an inner part 17 which engages directly hub 3 and an outer part or ring 18 which rests on a flange 19 which is a portion of inner part 17. Located between the spring support and top wall 11 are a series of springs 20, 21 and 22, the spring 20 being in engagement with ring 18 and the springs 21 and 22 being in engagement with inner part 17.

At spaced points around casing 10 are ears 23 to which are pivoted weights 24 held normally in vertical position by a surrounding garter spring 25. Each weight is provided with a toe 26 which rests under the spring supporting ring 18. A suitable number of weights 24, three or four for example, may be provided, and garter spring 25 which serves to oppose movements of the weights under the action of centrifugal force, may be chosen to give the desired operating characteristics to the weights. When shafts 1 and 7 are rotating, weights 24 are thrown outward by centrifugal force against the action of spring 25 when the speed reaches a certain value, thereby lifting ring 18 against the action of spring 20 to decrease the spring force acting downward on shaft 1.

The operation is as follows: When the shaft is not rotating, the springs 20, 21, and 22, which are under compression, exert a force on hub 3, pressing down on it and tending to resist tilting flange 4 on its support 6. These springs serve to exert on the shaft a counteracting force opposing the tendency of the shaft, with its unbalanced load, to rotate with a whirling motion. This force serves to give to the structure a stiffness such that its critical speed is higher than it would be were the spring force not exerted on the hub. When the shaft is being brought up to speed at a certain speed below the then critical speed, the weights 24 which operate after the manner of a fly-ball governor, move outward under the action of centrifugal force so that the toes 26 exert an upward force on ring 18 tending to raise it and thus take the pressure of spring 20 off hub 3. This serves to lower the critical speed of the structure, the arrangement being such that its critical speed will be lowered from its value above the then operating speed to a value below the then operating speed. Also, the arrangement is such preferably that the weights operate with a quick snap action whereby the critical speed of the structure is changed very quickly from the one value to the other. When the shaft is stopping, a similar action takes place, the weights serving to change the critical speed of the structure from the lower value to the higher value. The two critical speeds for the structure may be selected to have a desired difference between them and the weights may be arranged to effect the change from the one critical speed to the other at a desired speed value between the two critical speed values.

One application of the invention is in connection with centrifugal dryers for clothes washing machines, this being an instance where unbalance of the load is usually present. However, it is to be understood that the invention is not limited necessarily to this or similar uses, but may be used wherever found applicable.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination with a structure comprising a shaft having a driving means at one end and carrying at the other end an unbalanced load tending to cause the shaft to rotate with a whirling motion, of resilient means for exerting on the shaft a force counteracting the effect of the unbalanced load and giving the structure a certain critical speed, and means for varying the value of the force exerted by the resilient means while the shaft is rotating to change the critical speed of the structure.

2. The combination with a structure comprising a shaft having a driving means at one end and carrying at the other end an unbalanced load tending to cause the shaft to rotate with a whirling motion, of resilient means for exerting on the shaft a force counteracting the effect of the unbalanced load and giving the structure a certain critical speed, and means controlled by the speed of rotation of the shaft for changing the value of the force exerted by the resilient means to change the critical speed of the structure.

3. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion, of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a certain critical speed, and means for changing the value of the force exerted by the resilient means to change the critical speed of the structure.

4. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion, of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a certain critical speed, and means controlled by the rotation of the structure for changing the value of the force exerted by the resilient means to change the critical speed of the structure.

5. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion, of spring means acting on the structure to counteract the tendency of the structure to rotate with a whirling motion and to give the structure a certain critical speed, and means for changing automatically the action of said spring means on the structure while the structure is rotating to change the critical speed of the structure.

6. The combination with a structure comprising a shaft having a driving means at one end and carrying at the other end an unbalanced load tending to cause the shaft to rotate with a whirling motion, of a flange on the shaft, a supporting surface with which the flange engages, resilient means for forcing the flange against such surface to counteract the tendency of the shaft to rotate with a whirling motion and to give the structure a certain critical speed, and means for varying the value of the force exerted by the resilient means to change the critical speed of the structure.

7. The combination with a structure comprising a shaft having a driving means at one end and carrying at the other end an unbalanced load tending to cause the shaft to rotate with a whirling motion, of a flange on the shaft, a supporting surface with which the flange engages, resilient means for forcing the flange against such surface to counteract the tendency of the shaft to rotate with a whirling motion and to give the structure a certain critical speed, and speed controlled means for varying automatically the value of the force exerted by the resilient means to change the critical speed of the structure.

8. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion, of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a certain critical speed, centrifugally operated weight means rotated by the structure, and means controlled by said weight means for changing automatically the value of the force exerted by the resilient means to change the critical speed of the structure.

9. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion, of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a first critical speed, and automatic means controlled by the operation of the structure for decreasing the value of the force exerted by the resilient means as the speed of the structure approaches the first critical speed to give the structure a second critical speed below the then operating speed.

10. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a first critical speed, and automatic means controlled by the

operation of the structure for increasing the value of the force exerted by the resilient means as the speed of the structure approaches the first critical speed to give the structure a second critical speed above the then operating speed.

11. The combination with an unbalanced rotating structure having a tendency to rotate with a whirling motion of resilient means for exerting on the structure a force counteracting the tendency of the structure to rotate with a whirling motion and giving the structure a first critical speed, and automatic means controlled by the rotation of the structure for decreasing the value of the force exerted by the resilient means as the speed of the structure approaches the first critical speed to give the structure a second critical speed below the then operating speed and for increasing the value of the force exerted by the resilient means to the first mentioned value to restore the first critical speed, which is above the then operating speed, as the speed of the structure approaches the second critical speed.

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