United States Patent [19]

Kast

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[54] **HIGH SPEED OVERSPEED SENSOR**

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[73] Assignee: **The United States of America as represented by the Secretary of the Army,** Washington, D.C.

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[52] **U.S. Cl.** **73/521,** 137/830

[51] **Int. Cl.** **G01p 3/20,** G01p 3/26

[58] **Field of Search** 73/521; 137/56, 57, 137/81.5, 830, 831, 829

[56] **References Cited**

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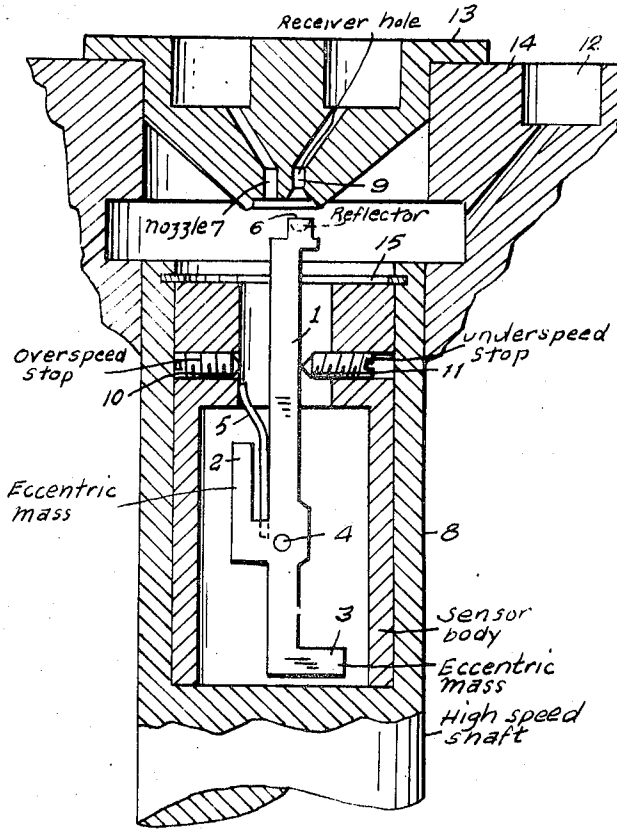
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[57] **ABSTRACT**

Simple inexpensive apparatus senses an overspeed condition of a high speed shaft, of a turbine for example. There is no wearing moving part unless the shaft overspeeds. Then one pivoted part or arm moves a very small degree carrying a cup-shaped reflector into the path of a small jet of fluid. This reflector cup reflects the jet stream to a receiver hole and conduit. The conduit leads off to apparatus which shuts off the engine or reduces the power input until the shaft speed is reduced below the overspeed limit.

6 Claims, 3 Drawing Figures



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Fig. 1.

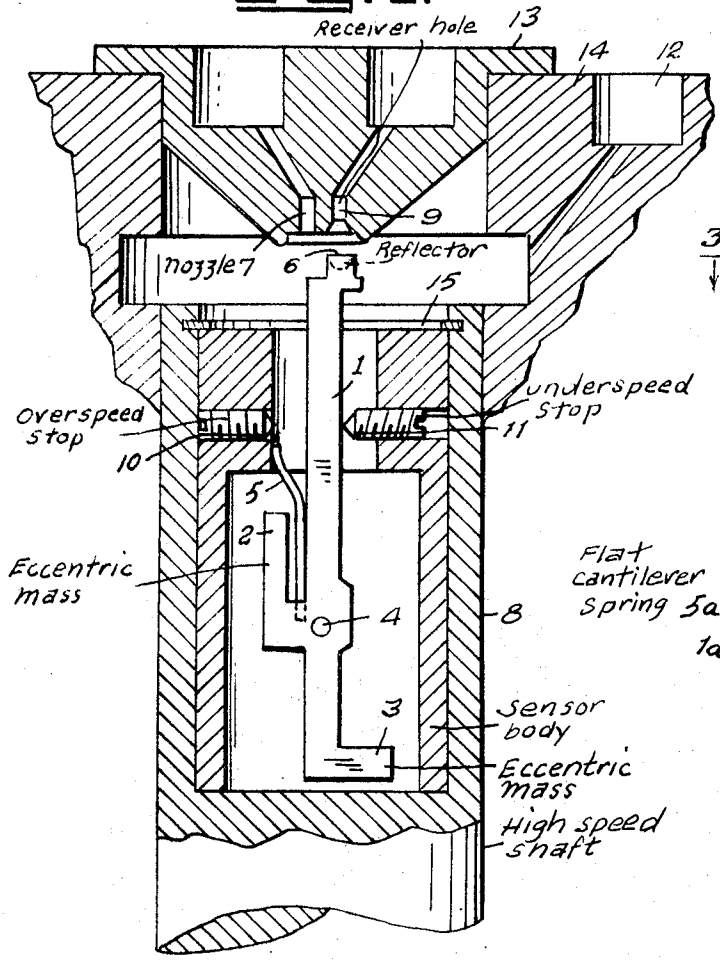


Fig. 2.

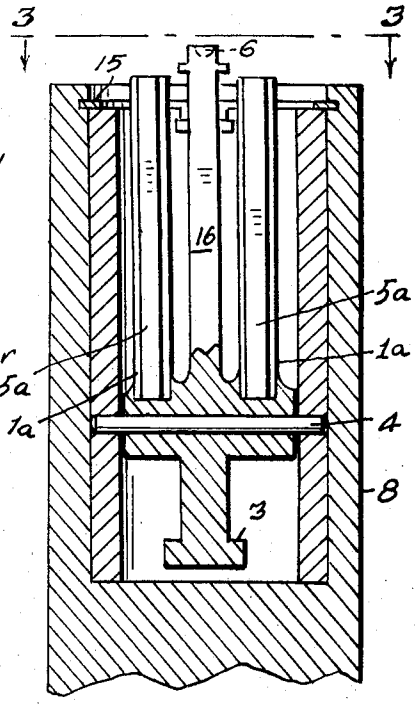
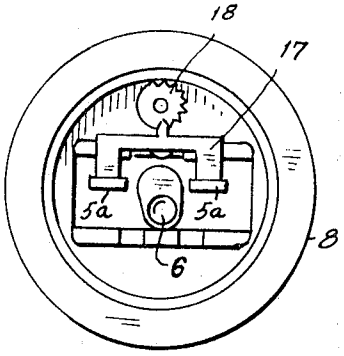


Fig. 3.



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HIGH SPEED OVERSPEED SENSOR

BRIEF SUMMARY

The present invention could be utilized in many types of apparatus where overspeed of a shaft is to be avoided. One example is a turbine where the load is normally always connected to the shaft but where a malfunction could cause the load to be lost quickly (e.g., a driven propeller blade may be feathered accidentally or deliberately very quickly, or the propeller blade may disintegrate). In order to prevent overspeeding and possible self-destruction of the turbine the power must be shut off instantly or sharply reduced.

Complicated apparatus is expensive to construct and to keep in repair and is likely to fail just when it is needed because of long periods of inaction previously. Moving parts, seals, bearings, springs and so on are potential sources of failure or trouble. The present apparatus completely eliminates all such parts for normal operation and even at overspeed only one small part simply pivots a few degrees from one position to another.

In the drawing:

FIG. 1 diagrammatically illustrates the invention.

FIG. 2 is a view of a modification.

FIG. 3 is a view along line 3—3 of FIG. 2.

Support arm 1, including eccentric masses 2 and 3, are mounted on pivot pin 4 extending through the center of rotation of shaft 8. Cantilever leaf spring 5 urges the pivoted assembly clockwise in FIG. 1.

At the top of pivoted arm assembly 1 there is a fluid reflector/deflector 6, that is, a socket-like cavity. Pressurized fluid (gas or liquid) is introduced at nozzle 7 and normally jets downwardly with no appreciable effect on operation of any apparatus. However, at high speed of rotation of shaft 8 the eccentric weights or masses 2 and 3 will overcome resistance of spring 5 and swing arm 1 counterclockwise. This places the left edge of reflector 6 in position to receive the jet of fluid and reflect it back up into receiver bore hole or conduit 9 which connects with a regulator or sensor device to control the speed of shaft 8.

An adjustable overspeed stop 10 limits movement of reflector 6 to the left at high speed. Adjustable stop 11 limits movement of reflector 6 to the right at low speed under the influence of psring 5.

Oil from the engine sump may enter at 12 to lubricate a bearing (not shown) supporting the shaft or for other purposes. It will be noted that no rotary seal is required, the cover 13 spring fixed and sealed to housing 14. As the shaft rotates at high speed the oil is slung outwardly thereby tending to create a cavity adjacent to reflector 6. However, even if no cavity is formed due to centrifugal force the spirit of the invention can be practiced by utilizing pressure at jet nozle 7 adequate to overcome resistance of any fluid between jet 7 and reflector 6, and between reflector 6 and receiver hole-conduit 9.

Ring 15 may be removed to permit the assembly to slide out from the end of shaft 8. Screws 10 and 11 may be adjusted before the assembly is slid into the shaft. Alternatively a hole or two could be drilled in the shaft to permit entry of a screw driver blade to adjust screws 10 and 11. The tension of spring 5 may be predetermined and established or may be re-set by removing the assembly and bending it, or by apparatus as illustrated in FIG. 2.

FIG. 2 is similar to FIG. 1. Instead of arm 1 a trifurcated member 16 is provided with arms 1a on each side. Twin springs 5a urge member 16, 1a, 1a toward its normal inactive position as discussed above. Arm 17 and a notched rotatable eccentric adjustment member 18 permit the adjustment of pressure on springs 5a. The springs 5*a* extend away from arms 1*a* in the same manner that spring 5 extends away from support arm 1 in FIG. 1 but instead of engaging the sensor body to hold the arm away from such body, the spaced springs 5*a* engage the arm 17 which in turn engages in one of the notches in the eccentric adjustment member 18. In order to adjust the tension of the springs the arm 17 is moved out of contact with eccentric member 18 which can then be rotated to the desired position where the arm 17 can be released to engage one of the notches in the eccentric and be held in such engagement by the pressure of springs 5*a*. Due to the eccentricity of the rotatable adjustment member 18, rotation of member 18 in a clockwise direction in FIG. 3 will move the arm 17 toward the axis of shaft 8, that is downwardly as viewed in FIG. 3, and thereby increase the tension on the springs 5*a*. Rotational adjustment of member 18 in the opposite direction toward its original postion illustrated in FIG. 3 will decrease the tension on the springs. The action of the adjustment member 18 to increase tension on the springs 5*a* is similar to the effect which would be produced by moving the upper end of spring 5 to the right in FIG. 1, thereby requiring more force to move the arm 1 toward the overspeed stop 10. Where two spaced springs 5*a* are used, the springs may be longer without interfering with engagement of the central arm 16 and the overspeed stop 10 which is located out of alignment with the spaced springs 5*a*. This permits easy setting of tension such that the member and reflector/deflector 6 will swing into the path of the jet of fluid at the speed of shaft 8 which is desired for a particular application.

With the foregoing description it is believed that operation of the apparatus will be obvious to those skilled in the art.

What is claimed is:

1. A device of the character described comprising a rotatable shaft, means pivotally mounting a supporting member at the axis of rotation of the shaft, said supporting member being pivoted about an axis extending transversely of the shaft axis and having a center of gravity off center with respect to the axis of rotation of the shaft, a jet nozzle arranged to project a stream of fluid under pressure in a path spaced from but substantially parallel with the axis of rotation of the shaft, a regulator conduit having a receiver port dispsoed in spaced relation adjacent to the jet nozzle out of alignment with the stream of fluid issuing therefrom, and a fluid-jet deflector carried by the pivoted supporting member in a normally inoperative position adjacent to but out of axial alignement with the jet nozzle and the stream of fluid issuing therefrom, said deflector being movable under the influence of centrifugal force applied to the pivoted supporting member by high speed rotation of the shaft to an operative position in alignment with the stream of fluid issuing from said jet nozzle, said deflector being shaped to change the direction of the stream of fluid impinging upon it from the jet nozzle and to redirect the stream into the receiver port of the regulator conduit.

2. The device of claim 1 having resilient means normally urging the deflector toward its inoperative position.

3. The device of claim 2 having an adjustable overspeed stop to control the limit of movement of the deflector under centrifugal force applied by high speed rotation of the shaft.

4. The device of claim 2 having means to vary the tension of the resilient means.

5. The device of claim 2 in which the rotatable shaft is provided with an axial chamber in which the pivoted supporting member is mounted.

6. The device of claim 2 in which the fluid-jet deflector is provided with a substantially cup-shaped concavity to receive and redirect the fluid stream from the jet nozzle.

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