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Czuszak et al.

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[54] **TRIP MECHANISM FOR TURBINE TRIP VALVE**

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[58] **Field of Search** 251/65, 69, 74

[56] **References Cited**

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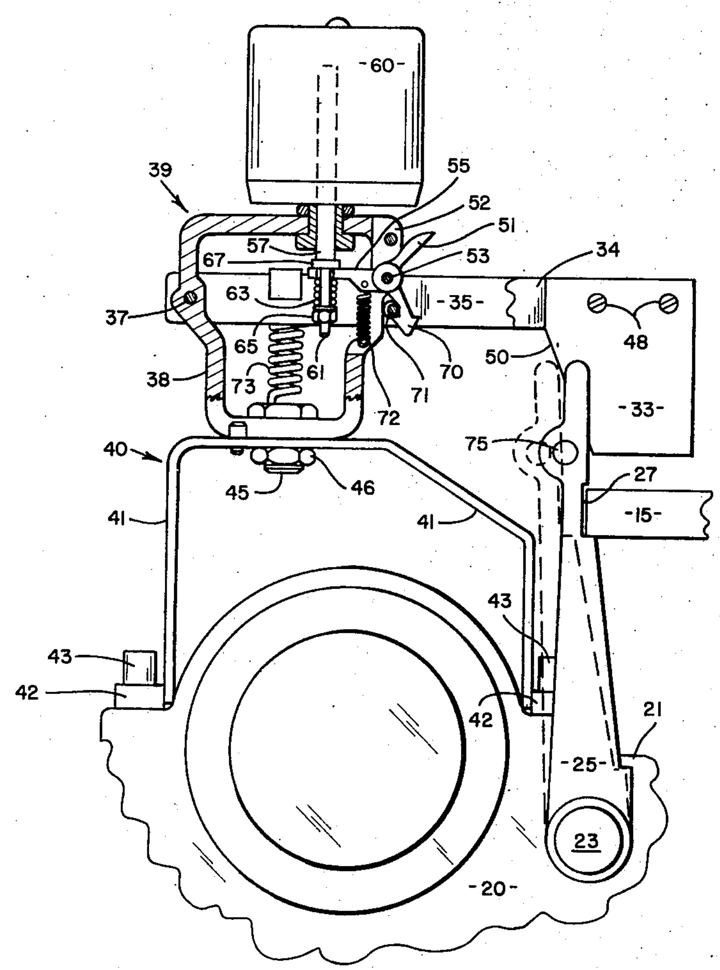
[57] **ABSTRACT**

The trip mechanism for operating the turbine trip valve to closed position includes an actuating lever mounted at one end for movement about a fixed pivot and being provided at the opposite end with a cam block. Spring means or the like acts upon the actuating lever to move the cam block into engagement with the trip valve restraining member to move it out of restraining position for closure of the trip valve. A latch is provided for latching the actuating lever against such pivotal movement. The latch is moved out of latching position by means, such as a solenoid, responsive to a signal indicative of an abnormal situation detrimental to the operation of the turbine.

4 Claims, 2 Drawing Figures



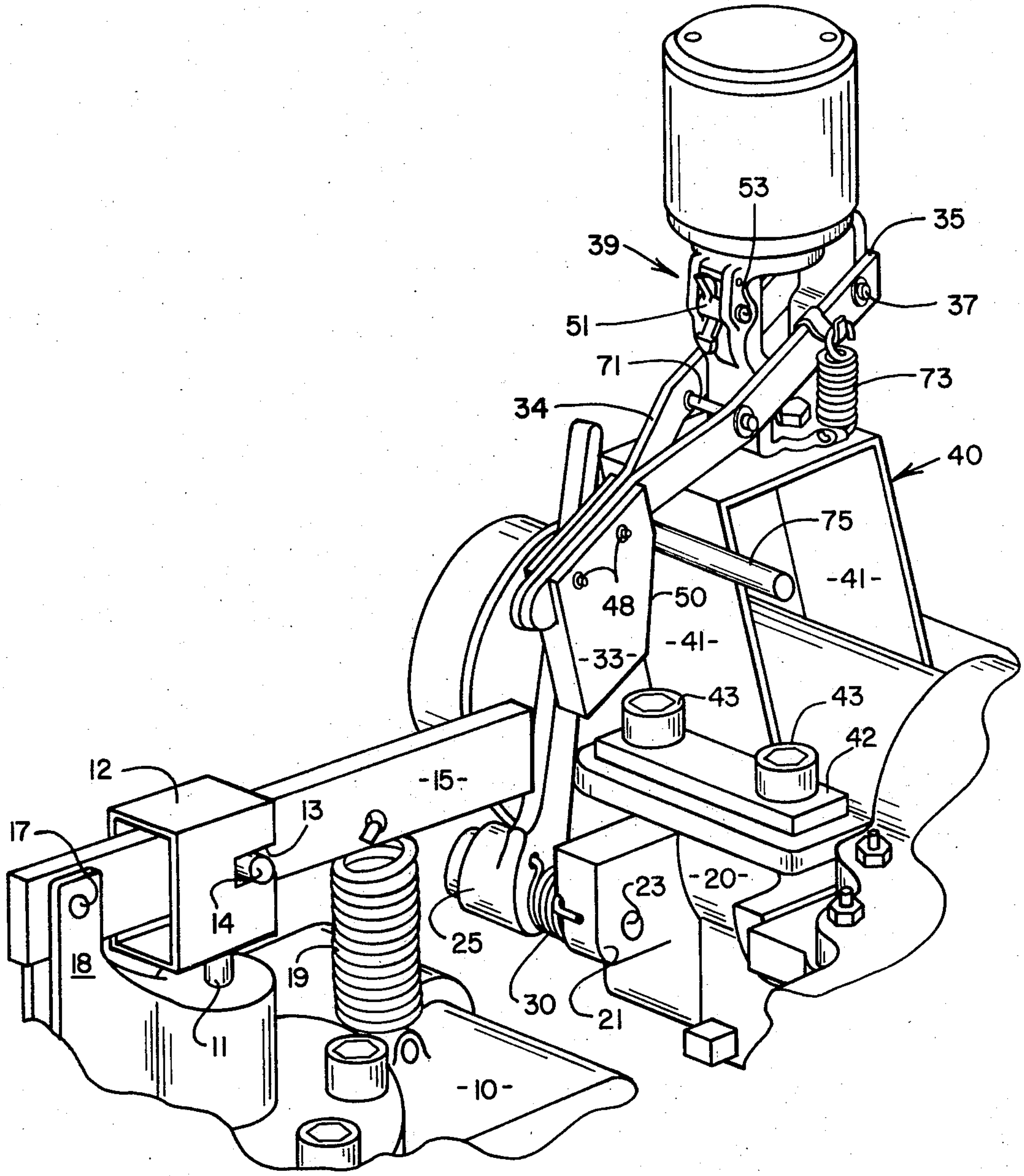


FIG. I

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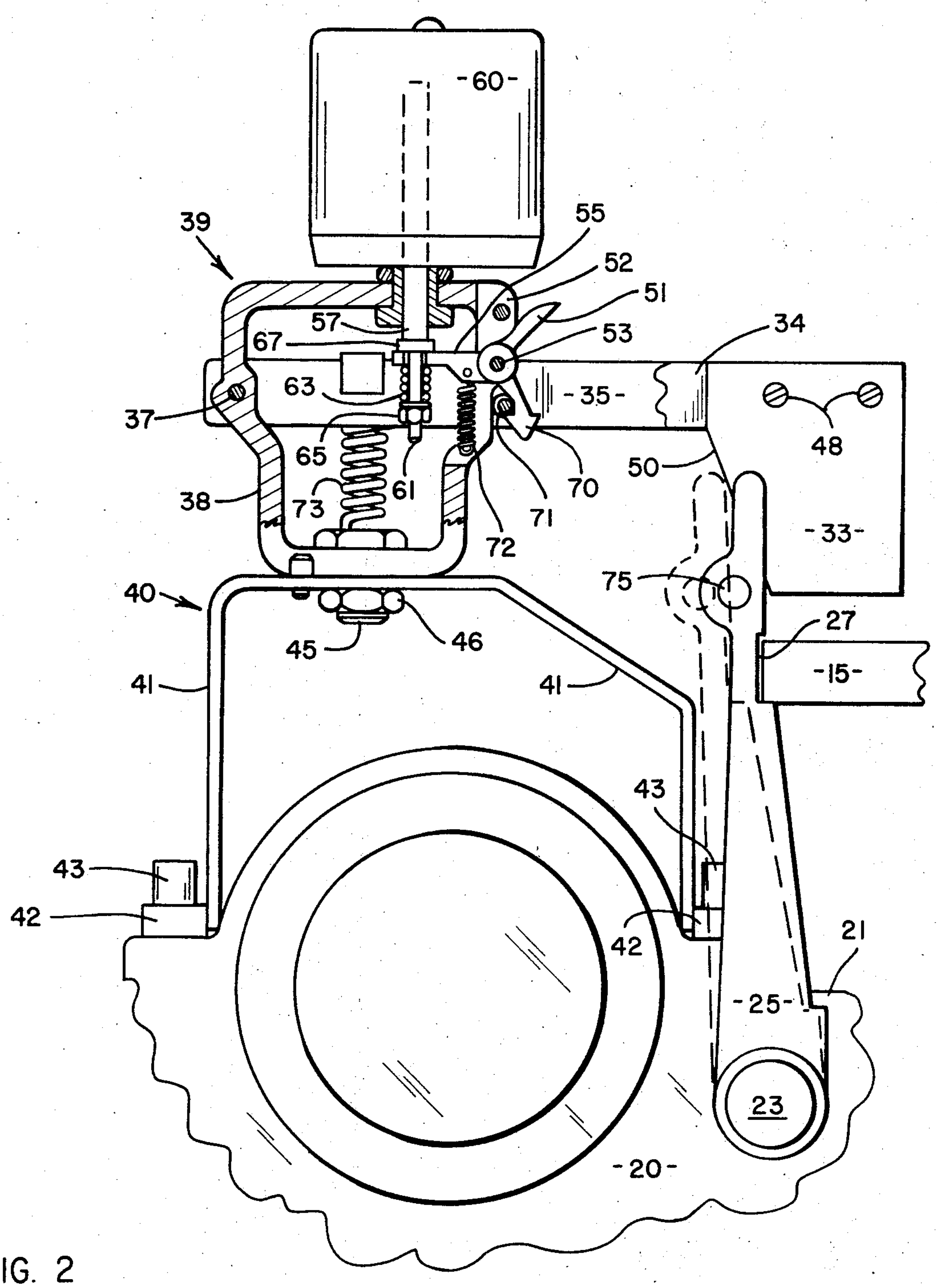

FIG. 2

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TRIP MECHANISM FOR TURBINE TRIP VALVE

BACKGROUND OF THE INVENTION

Fluid operated turbine machines are provided with a governor controlled supply valve for controlling the flow of operating fluid to the turbine. The valve is operated by a governor mechanism to maintain the set point speed of the turbine regardless of fluctuation of the load demand upon the turbine. It is also conventional practice to provide a trip valve and trip mechanism to close the trip valve upon the occurrence of an abnormal condition adversely affecting the operation of the turbine.

The overspeed trip valve is necessary due to the fact that the governor, and particularly the actuating mechanism between the governor and speed control valve, embodies a substantial amount of mechanism having a number of moving parts whereby there exists the possibility of failure of the governor and/or the mechanism to operate the steam control valve. The trip valve also serves to interrupt the flow of operating fluid to the turbine upon the occurrence of other abnormal conditions that adversely affect the operation of the turbine, as for example, insufficient pressure in the lubricating system due to an insufficient supply of oil or failure of the oil pump or the circuitry connected thereto. The trip valve is operated by a signal having an origin different from the signal operating the steam supply valve mechanism for speed control. At the present time, the mechanism for operating the trip valve includes a lever or the like connected to the valve and being urged to valve closing position by spring means or the equivalent. This lever is restrained against valve closing operation by a restraining member normally positioned in engagement with the valve operating lever. The restraining member conventionally takes the form of a pivotally mounted lever and the trip mechanism for moving it out of engagement with the valve operating lever, consists of a centrifugally operated trip pin which upon overspeed of the turbine, engages an arm associated with the lever to move it about its pivot out of engagement with the valve operating lever. In another form, a solenoid has a direct connection with the restraining lever and is operable upon receipt of a signal to move the restraining lever out of engagement with the valve operating lever. In this case, the signal may originate in the turbine or from another source, such as a low pressure oil switch. These trip structures have not consistently operated in a satisfactory manner due particularly to the lack of force applied to the restraining lever to quickly and with certainty to move it out of engagement with the valve operating lever. Also, such trip structures were tailored to the turbines individually.

This invention has as an object, a trip mechanism which is operable upon the receipt of a low power signal to quickly trip the trip valve to closed position. The trip mechanism involves a structural arrangement permitting its use with turbines of different sizes and designs.

SUMMARY OF THE INVENTION

An actuating lever is mounted at one end for movement about a fixed pivot which may be mounted in a bracket structure adapted to be mounted on the turbine casing. A cam block having an inclined surface is

fixed to the opposite end of the actuating lever. Force applying means, such as a spring, is provided to move the actuating lever about its pivot to move the cam block into engagement with the restraining lever which serves to hold the trip valve in open position. A latch is provided for latching the actuating lever against movement about its pivot to prevent the engagement between the cam block and the restraining member. A signal responsive means, responsive to an electrical or pneumatic or hydraulic signal moves the latch out of latching engagement, permitting movement of the cam block into engagement with the restraining member. The force applied to the restraining member is of substantial magnitude due to the inclined surface of the cam block and the springs acting upon the actuating lever.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in perspective of an overspeed control mechanism embodying our invention;

FIG. 2 is an end elevational view looking to the right of FIG. 1 and with parts in section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, **10** designates the casing of the trip valve which is connected in the fluid supply line to the turbine, upstream from the governor valve. The stem **11** of the valve extends outwardly from the casing and is provided with a box-like head **12** formed in opposite side walls with open ended slots **13** to receive an actuating pin **14**. The pin **14** is mounted in a valve operating member shown in the form of a lever **15** mounted for oscillation about a pivot pin **17** mounted in a bracket **18** fixed to the valve casing. A helical tension spring **19** is fixed at one end to the lever **15** and at its opposite end to the valve casing **10**. The spring serves to yieldingly urge the lever **15** downwardly about the pivot **17** for downward movement of the valve stem **11** to close the valve.

20 designates a bearing structure of the turbine and is formed with a laterally extending bracket **21** for the reception of a shouldered bolt **23**, on which there is pivotally mounted a restraining lever **25**. Restraining lever **25** is formed with a notch **27** for the reception of the free end of the valve operating lever **15**, see FIG. 2.

The restraining member **25** is yieldingly urged toward the lever **15** by a torsion spring **30** positioned on the bolt **23**, see FIG. 1. When the end of the operating lever **15** is positioned in the notch **27**, the trip valve is in open position. When the restraining member **25** is moved in a counter-clockwise direction about the bolt **23**, FIG. 2, to the dotted line position, the restraining member is moved out of engagement with the end of the operating lever **15** and the same is moved downwardly by spring **19** to close the trip valve and stop all flow of operating fluid to the turbine.

The restraining member **25** is moved out of engagement with the lever **15** by operation of a cam structure. As shown in FIGS. 1 and 2, the cam structure consists of a cam block **33** fixed to the free end of a lever consisting of a pair of arms **34, 35**. The opposite ends of the arms are mounted for oscillation about a pivot pin **37**, mounted in the rear wall **38** of a bracket **39**. The bracket **39** is mounted on a U-shaped support member

40, the legs 41 of which are welded at their lower ends to the plates 42, fixedly secured to the bearing housing 20, as by cap screws 43. The bracket 39 being fixed to the support 40 by a bolt 45 and nut 46.

The major portions of the arms 34, 35 extend on opposite sides of the bracket 39, the free end portions converging, as shown in FIG. 1, and are clamped together by bolts 48, which also serve to fixedly secure the cam block 33 to the arms. The block 33 is formed with an inclined cam surface 50. In FIG. 2, the arms 34 and 35 are disposed horizontally from the pivot pin 37 and are maintained in that position by a latch member 51. The latch is mounted in a slot 52 formed in the front wall of the bracket 39 for pivotal movement on a pin 53. The latch 51 has an inwardly extending arm 55, which in the structure shown in the drawings, is engaged by a plunger 57, mounted in a solenoid 60. The plunger 57 is formed with a stem 61 extending through the arm 55. A helical compression spring 63 is mounted on the stem 61 and interposed between the arm 55 and a nut 65. The plunger 57 is formed with an enlargement 67 engaging the upper surface of the arm 55.

With the employment of the solenoid 60, the arrangement is such that the solenoid is normally energized, holding the plunger in up position and maintaining hook portion 70 of latch 51 underneath a pin 71 mounted in the arms 34, 35. The produced signal is effective to deenergize the solenoid 60, permitting the plunger 57 to descend, and in conjunction with a tension spring 72 moving the latch 51 in a counter-clockwise direction about the pivot pin 53, and moving the hook portion 70 of the latch out of engagement with pin 71, whereupon the arms 34, 35 are moved downwardly by tension springs 73 connected between the arms and the base of the bracket 39.

This downward movement of the arms 34, 35 and the cam member 33 affixed thereto, causes the inclined cam surface 50 to engage a pin 75 extending laterally from the restraining member 25. This engagement effects counter-clockwise movement of the restraining lever 25 about the pivot bolt 23, FIG. 2, moving the notch 27 out of engagement with the free end of the valve operating lever 15 which is moved downwardly by spring 19 to close the trip valve.

It will be apparent that the latch 51 may be tripped by hydraulic or pneumatic means in place of the solenoid 60. The latch tripping means depends upon the type of signal transmitted to the tripping means. The employment of the cam member for moving the restraining lever 25 out of engagement with the valve closing lever 15 permits the use of a stronger spring 19 to more forcibly close the trip valve than in the case of the direct release of the restraining lever by the tripping means, as is conventional.

It also permits the use of the spring 30 of considerable torque to hold the restraining lever 25 into engagement with the valve operating lever 15, under such force as to obviate the displacement of the restraining lever by vibration during operation of the turbine.

The trip mechanism embodying our invention also has the advantage that it does not allow the trip valve to be reset while the signal produced by an abnormal situation persists. While it is possible to reset and latch the cam structure manually, it will immediately drop if the signal continues to exist. It also prevents the restarting or the operation of the trip turbine from a remote signal station.

While for purposes of illustration, a preferred embodiment of this invention has been described; it will be apparent that the invention may be otherwise embodied within the scope of the following claims.

We claim:

1. A trip mechanism for a trip valve controlling the flow of operating fluid to a turbine; an operating lever connected to said valve; and means acting on said lever to move said valve to closed position; a restraining member movable into and out of engagement with said lever and operable upon engagement therewith to restrain movement of said valve into closed position; said trip mechanism comprising a cam structure movable into and out of engagement with said restraining member and operable upon engagement therewith to move the same out of engagement with said valve operating lever; an actuating means responsive to a signal to effect movement of said cam structure into engagement with said restraining member.

2. A trip mechanism as set forth in claim 1 wherein said actuating lever is pivotally mounted in a bracket adapted to be mounted on the turbine structure and said signal responsive actuating means is fixed to said bracket and operatively connected to said latch.

3. A trip mechanism for a trip valve controlling the flow of operating fluid to a turbine; an operating lever connected to said valve; and means acting on said lever to move said valve to closed position; a restraining member movable into and out of engagement with said lever and operable upon engagement therewith to restrain movement of said valve into closed position; said trip mechanism comprising a cam structure including a cam lever mounted at one end for movement about a fixed pivot; a cam block fixed to the opposite end of said cam lever; pressure exerting means acting on said lever to move the same about said pivot to move said cam block into engagement with said restraining member; said cam block being operable upon such engagement to move said restraining member out of engagement with said valve operating lever; latch means movable into engagement with said cam lever for restraining movement thereof by said pressure exerting means and means responsive to a signal to move said latch out of latching engagement with said cam lever.

4. A trip mechanism as set forth in claim 3 wherein said restraining member consists of a lever mounted at one end for movement about a fixed pivot; said lever being provided at its opposite end with a cam block engagable projection extending laterally from said lever in a direct parallel to said pivot.

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