Jan. 9, 1968 H. J. SHAFER 3,362,300

ADJUSTABLE CAM STOP FOR ROTARY VANE MOTORS

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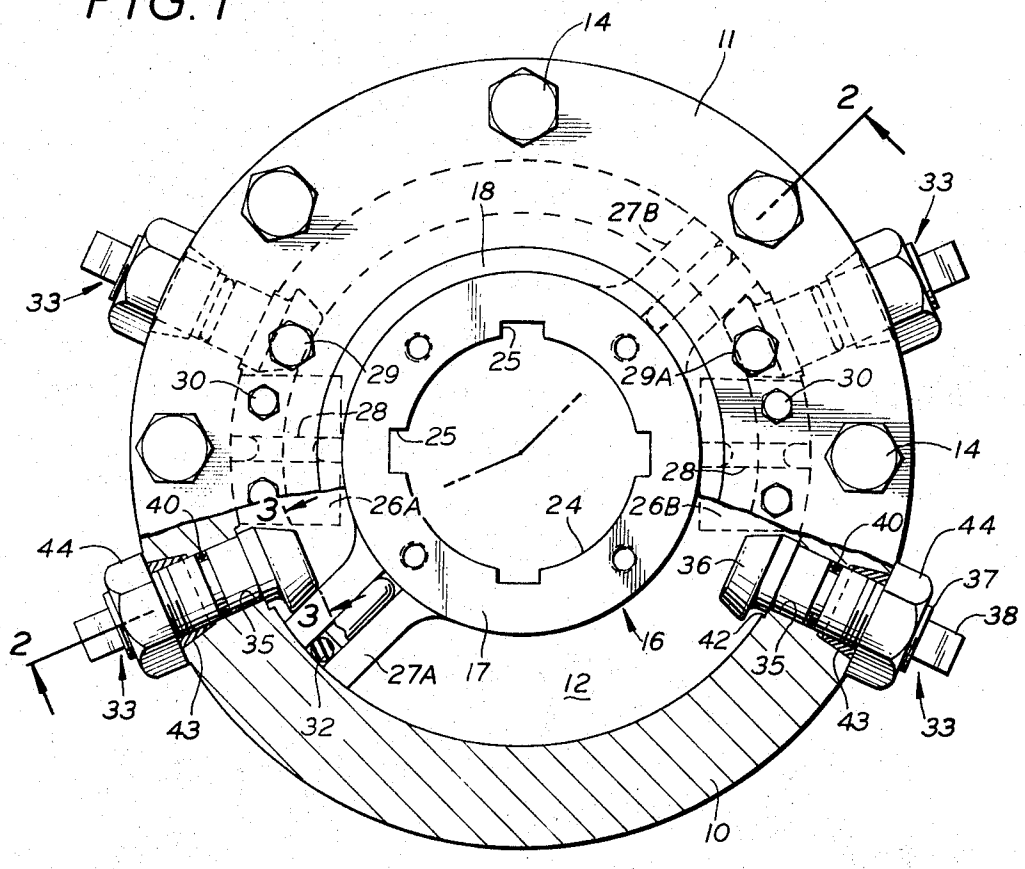
FIG. 1



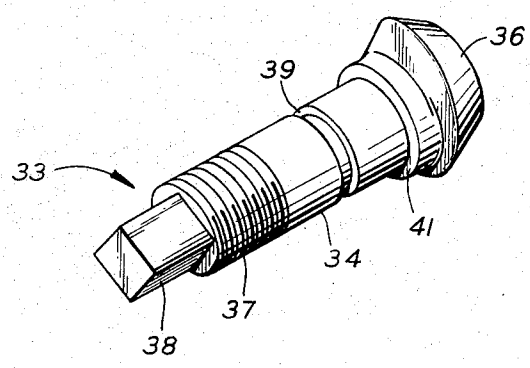


FIG. 4

INVENTOR.
HOMER J. SHAFER
BY Hamilton & Cook
ATTORNEYS

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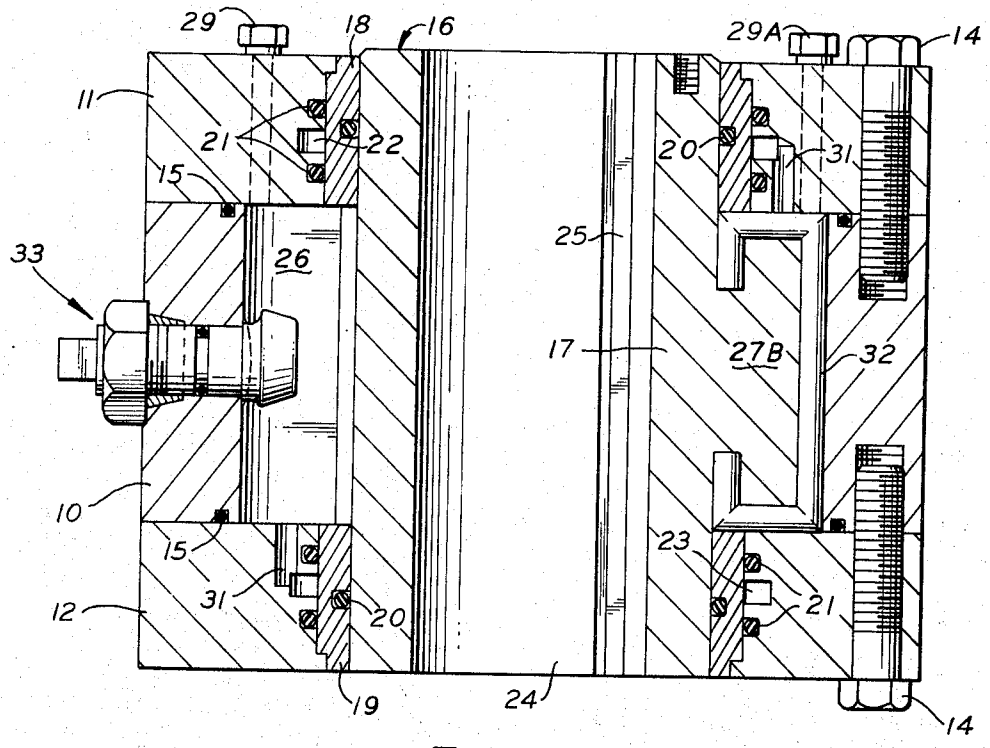

FIG. 2

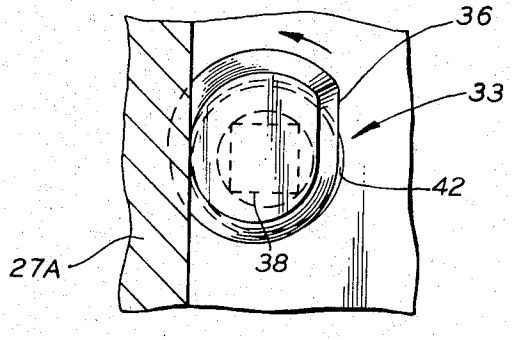

FIG. 3

INVENTOR.
HOMER J. SHAFER
BY Hamilton & Cook
ATTORNEYS

United States Patent Office

3,362,300

Patented Jan. 9, 1968

3,362,300

ADJUSTABLE CAM STOP FOR ROTARY VANE MOTORS

Homer J. Shafer, 2300 Park Ave. W., Mansfield, Ohio 44906

Filed July 1, 1965, Ser. No. 468,710
2 Claims. (Cl. 92—13)

The present invention relates to rotary or oscillating vane hydraulic valve operator motors, and more particularly to adjustable stops for abutting the motor vanes.

In rotary vane hydraulic motors used as operators for large pipeline valves, the motor must be precisely aligned with the valve so that the rotary travel of the vanes terminates exactly at the fully closed and fully open positions of the valve, and adjustment of the stops for the vanes to accomplish this result should be made externally of the motor to save time and enable adjustments while the motor is filled with hydraulic fluid under high pressure.

One form of adjustable stop is shown and described in U.S. Patent No. 3,171,332, issued Mar. 2, 1965, comprising a stop which slidably abuts a stationary shoe defining the internal pressure chamber of the motor, and which has a beveled edge for stopping rotation of the vane, with an adjustment stud screwed into the stop for sliding it radially of the shoe.

A major disadvantage of this prior stop is that when the vane strikes the stop the high pressure on the vane is transmitted to the stationary shoe and tends to loosen and displace it during repeated use. Also, the prior stop is relatively expensive to manufacture, and requires machining of the abutment surface on the shoe.

It is an object of the present invention to provide improved adjustable stop means for a hydraulic rotary vane motor to precisely limit the rotary movement of the vanes.

Another object is to provide improved stop construction which is adjustable externally of the motor while it is filled with high pressure fluid.

A further object is to provide improved stop means which transmits the pressure on the vane to the wall of the motor.

A still further object is to provide improved stop means which is inexpensive to manufacture and does not require machining of the internal shoe.

These and other objects are accomplished by the improvements of the present invention which are described in the specification and shown in the drawings herein, and which are defined in the claims, along with various modifications and variations in construction.

Referring to the drawings:

FIG. 1 is a plan section view, partly in elevation, of a rotary vane motor embodying the invention.

FIG. 2 is a vertical sectional view taken on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary sectional view on line 3—3 of FIG. 1.

FIG. 4 is a perspective view of the adjustable cam stop detached from the assembly.

The rotary vane motor preferably includes a cylindrical casing **10** having top and bottom cover plates **11** and **12**, respectively, forming a closed cylindrical chamber, the plates being secured to the casing **10** by circumferential rows of screw studs **14**. The joints between the casing and the plates may be sealed by O-ring gaskets **15**.

The rotor **16** comprises a hub **17** having its ends journaled in the end plates **11** and **12** by sleeve bearings **18** and **19**, respectively, and the bearings each have O-rings **20** at the bearing surface to prevent leakage of hydraulic fluid from the motor and to keep out foreign matter.

Each sleeve bearing preferably has a pair of fluid and dust sealing O-rings **21** surrounding the bearing and located in annular grooves in the cover plates **11** and **12**. Between each pair of rings **21** is an annular groove **22** and **23**, respectively.

The rotor hub **17** has an axial bore **24** extending therethrough with one or more keyways **25** for splined mounting on the stem of a rotary valve (not shown) which may be a plug valve or a ball valve. The manner of supporting the rotary vane motor on the rotary valve per se forms no part of the invention and is not shown.

The rotary vane motor has a pair of diametrically opposite stationary shoes **26A** and **26B** disposed within the motor chamber to bisect it into two chambers within which the vanes **27** of the rotor oscillate. Each shoe preferably comprises a rectiliner block with at least one rectilinear O-ring **28** carried in a groove extending around the vertical perimeter of the block. The shoes **26** have a close tolerance fit with the rotor and the inside wall of the casing **10**, and the O-rings **28** provide effective seals preventing leakage of hydraulic fluid between the two chambers of the motor. As shown, the shoes may be secured to the top and bottom plates **11** and **12** by screw studs **30**.

The rotor vanes **27A** and **27B** may be blocks welded to the rotor hub at diametrically opposite locations, or may be integrally formed with the rotor hub or attached thereto by other suitable means. As shown in FIG. 2, each vane preferably has at least one rectilinear O-ring **32** disposed substantially around its vertical perimeter in continuous fluid-tight engagement with the inner wall of the casing **10**, and with the end plates **11** and **12** to prevent leakage of fluid past the vane as it oscillates in the motor chamber.

Suitable external pressure and exhaust connections **29** and **29A** are provided for supplying hydraulic fluid to the motor and exhausting it therefrom. Also, crossover porting is preferably provided for balanced torque operation by directing pressure fluid to opposite sides of both vanes simultaneously. Thus, the annular grooves **22** and **23** are connected by ports **31** to the chambers on opposite sides of the vanes. The details of the supply and exhaust and crossover porting form no part of the present invention, and may be further explained by reference to Patent No. 2,811,142, dated Oct. 29, 1957.

As shown in FIG. 1, there are four adjustable cam stops indicated generally at **33**, one at each end of each of the two motor chambers formed by the diametrically opposite shoes **26A** and **26B**. It will be understood that only two cam stops may be used, one on either side of one of the shoes **26A**, for example, in which case vane **27A** abuts one of the stops at one end of the rotor travel, and vane **27B** abuts the other of the stops at the other end of the rotor travel. The use of four stops is preferred to provide balanced torque on the rotor when it is stopped at either end of the rotor travel corresponding to the fully open and fully closed positions of the valve.

The improved cam stops **33** each preferably comprise a shank **34** extending through a close fitting bore **35** in the cylinder wall, and having an integral cam **36** on its inner end and a threaded portion **37** at its outer end, with a squared wrench-engaging portion **38**. The shank has an O-ring groove **39** for receiving an O-ring **40** to make a seal between the shank **34** and the bore **35**. Adjacent to the cam **36** is an annular shoulder **41** which is adapted to seat against an internal spot face **42** which is a planar annular surface surrounding the bore on the inner surface of the casing **10**.

A tapered locking bushing **43** is seated in a tapered socket at the outer end of bore **35** for abutting a lock nut **44** screwed on the threaded portion **37** of the shank

to lock the shank against turning in the bore after it has been adjusted.

As best shown in FIG. 3, the cam 36 has a substantially spiral periphery terminating at an outer point, so that rotation of the cam presents a cam edge of varying radius to afford an adjustable stop for the vane at the end of its travel in one direction. By rotating the position of the cams, they can be adjusted accurately to stop the rotor exactly at the fully open and fully closed positions of the valve. The cams are designed to provide a total angular adjustment of the rotor of about two and one-half degrees.

The adjustment is easily made externally of the fluid motor after it is assembled and filled with fluid under pressure. All that is necessary is to loosen the lock nut 44 and then rotate the shank 34 by applying a wrench to the squared end 38. When the adjusted position has been located, the lock nut 44 is tightened to maintain the cam stop in position.

Each time the vane abuts the cam at the end of its travel, the impact is transmitted through the shoulder 41 abutting spot face 42 to the cylinder wall 10 and not to the adjacent shoe 26A or 26B as is the case with the stop in Patent No. 3,171,332. Thus the shoes are not subjected to any impacts tending to cause them to work loose. Moreover, no machining of the shoes is required to provide an abutment face thereon.

It is apparent that the objects of the invention are accomplished by the improved adjustable cam stop which is inexpensive to manufacture, and easy to adjust externally of the hydraulic motor.

What is claimed is:

1. In a rotary vane fluid motor having a closed cylindrical housing, a rotor hub having a vane oscillatable in said housing, and means defining a pressure chamber within which the vane oscillates, the improvement comprising an adjustable cam stop for abutting the vane to limit its motion, said cam stop having a shank extending through said housing for transmitting the pressure from the vane to said housing, said cam stop having an internal shoulder with a planar surface, a planar spot face on the inner surface of said housing abutting the planar surface of said shoulder, an integral cam on the inner end of said shank having a spiral peripheral surface for surface abutment with the vane in various positions of adjustment, and means on the outer end of said shank for locking said stop with said cam in a position of rotary adjustment.

2. A device as defined in claim 1 in which said locking means comprises a tapered lock bushing in said housing engaging said shank, and a nut screwed on the outer end of said shank in abutment with said bushing for clamping said shoulder in abutment with said spot face and for locking said cam stop with said cam in a position of rotary adjustment.

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MARTIN P. SCHWADRON, *Primary Examiner.*