Sept. 21, 1965 R. D. RUMSEY 3,207,048

ROTARY ACTUATOR STRUCTURE

Original Filed Feb. 3, 1961 2 Sheets-Sheet 1

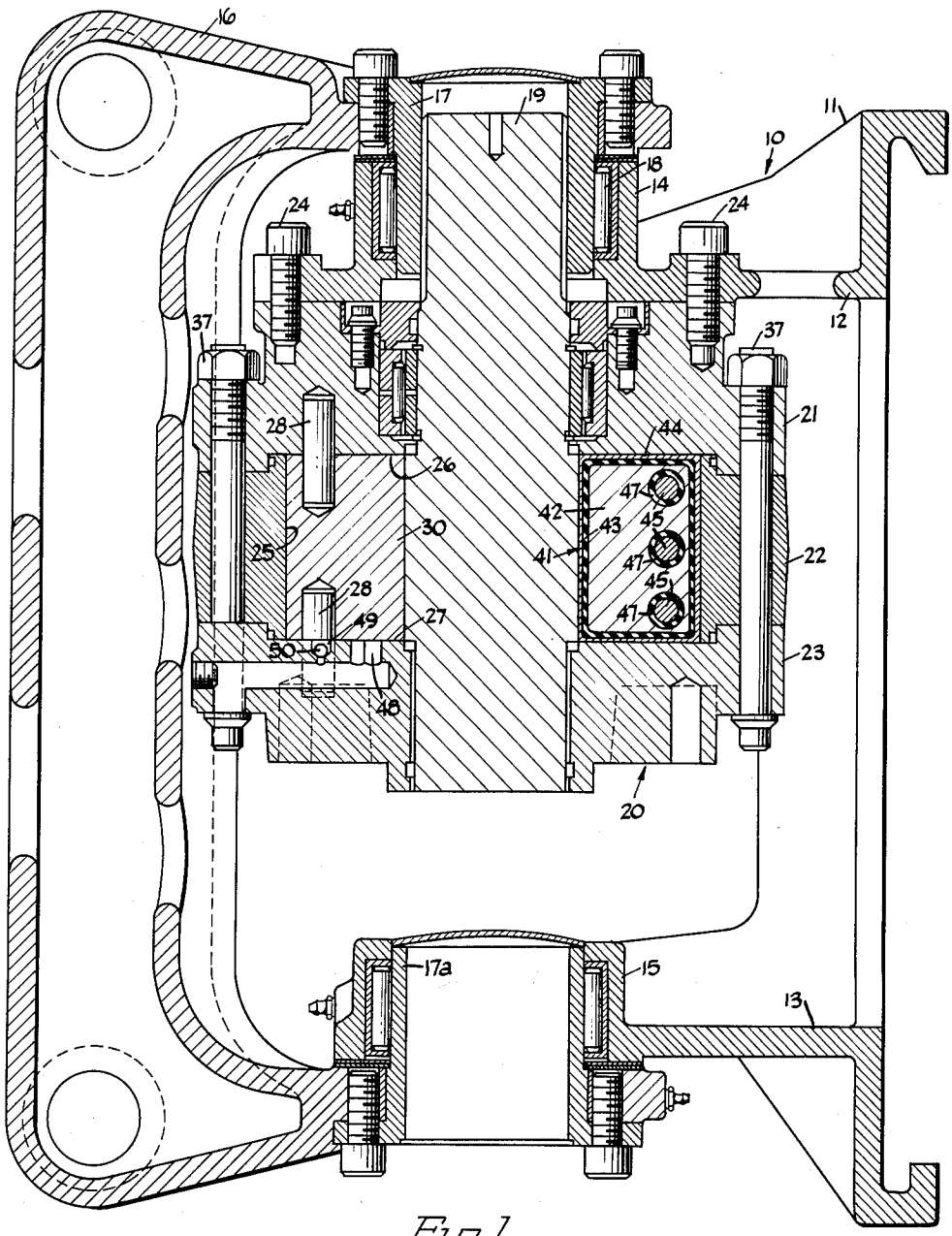

Fig 1

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Fig 2

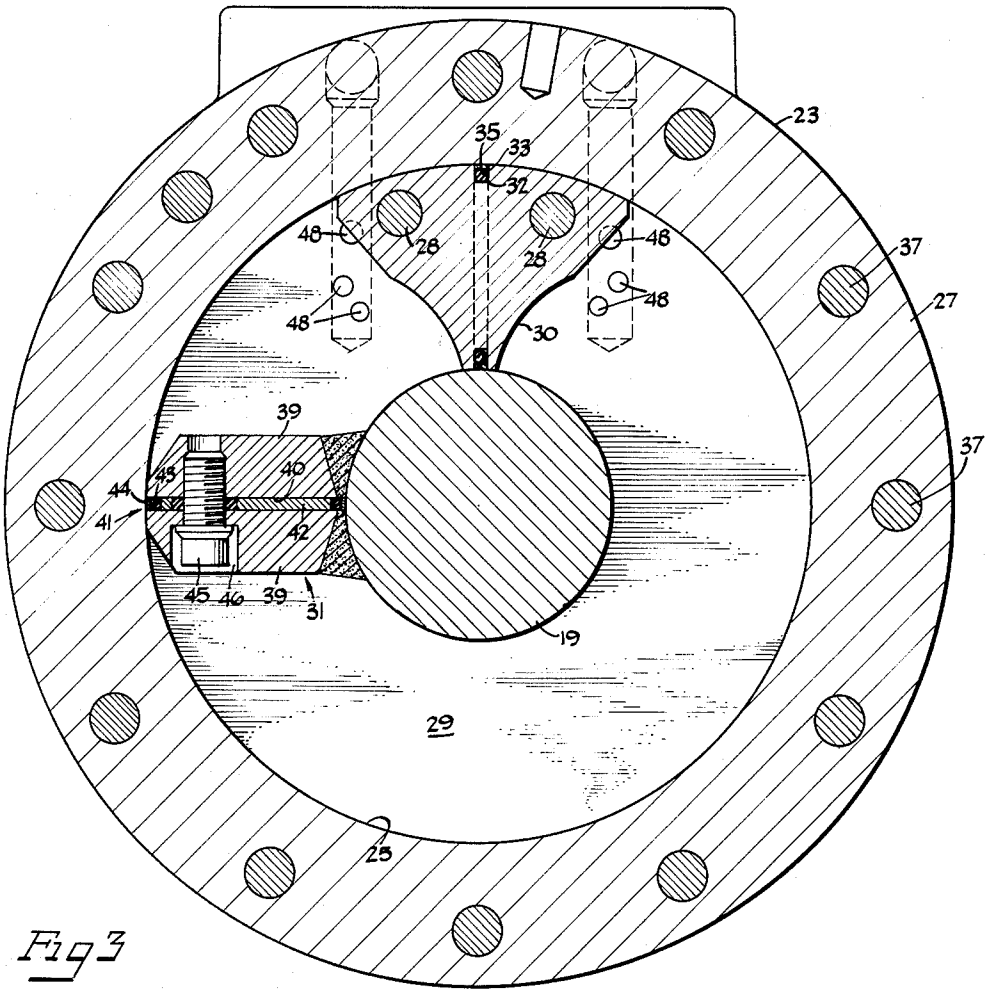
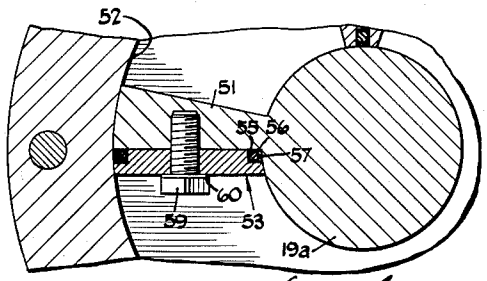


Fig 3



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3,207,048

ROTARY ACTUATOR STRUCTURE

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Original application Feb. 3, 1961, Ser. No. 86,904, now Patent No. 3,103,281, dated Sept. 10, 1963. Divided and this application Jan. 25, 1963, Ser. No. 253,937

3 Claims. (Cl. 92—125)

This application is a division of application Serial No. 86,904, filed February 3, 1961, now Patent No. 3,103,281, and entitled "Rotary Actuator Unit Mount for Booms and the Like."

This invention relates to improvements in rotary actuators and more particularly relates to an improved form of wing structure and sealing means for rotary actuators.

Rotary actuators of the vane type have come into common use for actuating the booms of earth moving equipment and are usually an integral part of the mounting for the boom and hold the boom in position and turn the boom about a vertical axis during operation of the boom. In such actuators, the loads and internal pressures in the actuator are relatively high, and in order to achieve high mechanical efficiency, particularly where the actuator has only a single vane, it is necessary that the radial distance from the center of the shaft to the outside of the vane be as large as possible in proportion to the diameter of the shaft. Such a large or tall vane configuration of necessity requires that the base of the vane be relatively thick to carry the bending load imposed thereon by the fluid pressure acting on the vane.

Another requirement for such actuators is that the vane have a maximum amount of angular travel and in order to attain this, the base of the vane of necessity must be thin as possible.

As the result of these two requirements, high stress levels are introduced into the vane where it joins the shaft and the vane must be slotted for its full depth to accommodate the seal fitting into the slot between the two vane parts and thereby forming the vane in the form of two separate vanes, each having strength capabilty of carrying the full load on the vane. This greatly increases the width of each vane part and as a result restricts the travel of the actuator.

A principal object of the present invention is to overcome these weaknesses in the vanes of rotary actuators by providing an actuator vane in the form of two vane parts and providing a structural tie between the vane parts.

Another object of the invention is to provide an improved rotary actuator for the booms for derricks, back hoes and the like, arranged with a view toward maximum travel in an angular direction without impairing the strength of the vane of the actuator.

Still another object of the invention is to provide an improved form of rotary actuator utilizing a vane in two parts, in which the space between the vane parts carries a unitary seal, and in which a structural tie between the vane parts is provided to retain the seal in position, and to join the parts to act as a unitary vane.

A further and more detailed object of the invention is to improve upon the rotary actuators heretofore in use for boom mounts and the like, by increasing the strength of the actuator vane structure by bolting a unitary seal assembly to one side of the vane.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a vertical sectional view taken through a boom mount, with the boom and actuating cylinder therefor removed, and showing an actuator constructed in accordance with the invention in composite section;

FIGURE 2 is a horizontal sectional view taken through the actuator shown in FIGURE 1; and

FIGURE 3 is a fragmentary view illustrating a modified form in which our invention may be embodied.

In the embodiment of the invention illustrated in the drawings, I have shown in FIGURE 1 a boom mount **10** including a bracket **11** adapted to support the boom mount at the rear of a truck and the like, as in parent application Serial No. 86,904. The bracket **11** has a pair of parallel spaced arms **12** and **13** extending horizontally rearwardly therefrom having vertical bosses **14** and **15** respectively, formed integrally therewith, forming a mounting for a boom support **16**. A flanged sleeve **17** is suitably secured to the upper end portion of the boom support **16** and extends axially inwardly along the boss **14** and is journalled in said boss on a bearing **18**. The sleeve **17** also has a shaft **19** of a rotary actuator **20**, splined thereto, for moving the frame **19** laterally about the axes of the bosses **14** and **15**. A similar sleeve **17***a* is suitably secured to the lower end of the boom support **16** and is journalled in the lower boss **15**.

The rotary actuator **20** is shown in FIGURE 1 as having three aligned casing parts **21**, **22** and **23**, the upper casing part of which abuts the underside of the arm **12** and is secured thereto as by cap screws **24**. The central casing part **22** is in the form of a spacer, spacing the casing parts **21** and **23** apart and has an internal cylindrical wall **25** cooperating with inner end walls **26** and **27** of the respective casing parts **21** and **23** to define actuating chambers **29** of increasing and decreasing volume on opposite sides of a stationary abutment **30**, extending inwardly of the cylindrical wall **25** of the casing part **22**, and a sliding wing vane **31** extending generally radially of the shaft **19**.

The abutment **30** is mounted within the actuator housing in fixed relation with respect thereto, as by dowels **28** mounted in the fixed abutment **30** and extending within the end housing members **21** and **23**, as shown in FIGURE 1. The fixed abutment **30** has a groove **32** extending thereabout having an O-ring **33** stretched therein and having a plastic seal **35**, having a flat sealing face, extending thereabout. The plastic seal **35** may be made from Teflon or a like sealing material, and forms a seal, sealing the fixed abutment **30** to the shaft **19**, the internal cylindrical wall **25**, and the end walls **26** and **27** of the damper housing. The end housing parts **21** and **23** are secured to opposite faces of the intermediate spacer member **22**, as by through bolts **37**.

The vane or wing is shown as being in two vane parts **39**, **39** welded or otherwise secured to the shaft **19**. The space between the vane parts **39** forms a slot **40** extending generally diametrically of the shaft **19** and receiving a seal **41**. The seal **41** includes a generally rectangular spacer **42** having an O-ring **43** stretched thereabout. A plastic seal **44** having a flat outer sealing face extends about the O-ring **43** and forms a continuous seal engaging the periphery of the shaft **19**, the inner cylindrical wall **25** of the intermediate housing part **22** and the inner faces **26** and **27** of the end housing parts **21** and **23**. The plastic seal **44** may be made from a suitable plastic sealing material, such as Teflon, nylon or any other similar material.

The seal **41** including the spacer **42**, O-ring **43** and plastic outer seal **44** is inserted in the slot **40** formed by the space between the wing parts **39**. As shown in FIGURE 2, machine screws **45** extend through the two wing parts **39** and the spacer **42** and are threaded in one wing part. The heads of the machine screws are recessed within recessed portions **46** of one vane part **39** and are threaded within the other vane part, to structurally

tie the two vane parts together, and to avoid interference of the head of the machine screw with the vane **30**, at one end of the arcuate stroke of travel of the shaft **19**. The machine screws **45** are sealed to the spacer **42** by thread seals **47**, mounted in the spacer **42**. The thread seals **47** may be made from rubber or one of the well known substitutes for rubber. The machine screws **45**, typing the two vane parts together, distribute the load between the two vane parts as the pressure acts on one vane part and thereby strengthen the two vane parts, making it possible to use a relatively tall vane, thin enough to give a full stroke of at least 270° to the actuator without interfering with the abutment **30** at opposite ends of the stroke of the vane. The construction just described thereby provides a rotary actuator having a relatively large working arc in which the structural weaknesses heretofore present in such actuators, due to the height of the vane, have been overcome.

Inlets **48** lead into the lower housing part **23** and enter the working chamber **29** on opposite sides of the stationary abutment **30**, through the wall **27** of the housing part **23**. A check valve chamber **49** leads from an inlet **48** toward the outer end portion of the actuator chamber **29**, and is partially covered by the abutment **30**. The abutment **30** thus retains a ball type check valve **50** in its check valve chamber. The check valve chamber serves to cushion movement of the actuator toward the ends of its strokes as the passageways leading through the outlets are closed by a vane part **39**, it being understood that one inlet **48** serves to admit fluid under pressure to one actuator chamber, while the other inlet serves to release fluid under pressure from the opposite actuator chamber.

In the modified form of the invention shown in FIGURE 3, an actuator shaft **19*a***, like the actuator shaft **19**, is shown as having a vane **51** formed integrally therewith and extending generally radially therefrom into close proximity to an inner cylindrical wall **52** of the actuator housing. In this form of the invention a unitary seal assembly **53** is bolted or otherwise secure to one face of the wing or vane **51**. The seal **53** may be in the form of a rectangular plate having a rectangular groove or recess **55** extending thereabout and opening to the wing **51**. The groove **55** contains an O-ring **56**, stretched about the wall of the grooved portion of the retainer **53**. The O-ring **56** has a plastic seal **57** extending thereabout, having flat sealing right angle sealing faces having sealing engagement with the shaft **19*a***, opposite end walls of the working chamber and the inner cylindrical wall of the working chamber, like the seal **41**. Machine screws **59** extend through the retainer **53** and are shown as being threaded within the wing or vane **51**. A washer **60**, which may be a sealing washer extends about the machine screw **59** and is interposed between the head of the machine screw and the outer face of the retainer **53**.

It should be understood that while I have herein shown machine screws as securing the retainer to the vane **51** that through bolts may be used if desired, and that where through bolts are used the washer **60** may be a high pressure seal preventing leakage along the bolt.

In the form of the invention illustrated in FIGURE 3, the bolts or machine screws **59** carry the full vane load in one direction of rotation of the vane and are under no load in the opposite direction of rotation of the vane. With this type of design, a far stronger vane may be attained than with an unbolted vane and the vane structure itself may be thinner than with a bolted vane in two vane parts, as in the form of the invention illustrated in FIGURES 1 and 2.

While I have herein shown and described one form in which my invention may be embodied, it may be understood that various modifications and variations in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In a rotary actuator, a housing having an actuator chamber therein having end walls and an inner peripheral wall connecting said end walls together, a fixed abutment extending across said peripheral wall, inlets into said chamber and outlets from said chamber on opposite sides of said fixed abutment, a shaft rotatably journalled in said housing, said shaft having at least two vane parts extending generally radially therefrom and spaced apart to define a generally radial sealing slot, unitary sealing means insertable within said slot and having slidable sealing engagement with a wall of said chamber, said sealing means comprising a spacer, an O-ring extending about said spacer, a plastic seal extending about said O-ring and having right angled rectilinear sealing faces having sealing engagement with the end walls and an inner peripheral wall of said chamber, threaded means structurally tying said wing parts together and extending through said spacer, and thread sealing means extending around said threaded means within the margins of said spacer.

2. In a rotary actuator, a housing having an actuator chamber therein having a fixed abutment extending thereacross, inlets into said chamber and outlets leading from said chamber on opposite sides of said abutment, a shaft rotatably journalled in said housing, said shaft having at least two vane parts extending generally radially thereof and spaced apart to define a generally radial sealing slot, unitary sealing means insertable within said slot and having slidable sealing engagement with a wall of said chamber, said sealing means comprising a spacer, an O-ring stretched about said spacer, a plastic seal having right angled rectilinear sealing faces extending about said O-ring and having sealing engagement with the end wall and an inner peripheral wall of said chamber, threaded means structurally tying said vane parts together and extending through said spacer, and thread seals in said spacer, extending about said threaded means.

3. An actuator vane structure for rotary actuators and the like comprising, an actuator shaft, at least two vane parts extending generally radially of said shaft and spaced apart to define a generally radial sealing slot, welding means securing said vanes to said shaft, unitary sealing means insertable within said slot and including a spacer having a seal extending thereabout, spaced thread seals carried by said spacer, and threaded means structurally tying said vane parts together and extending through said thread seals in said spacer.

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