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MECHANICAL LINKAGE WITH LIQUID SEALING MEANS

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Fig.1.

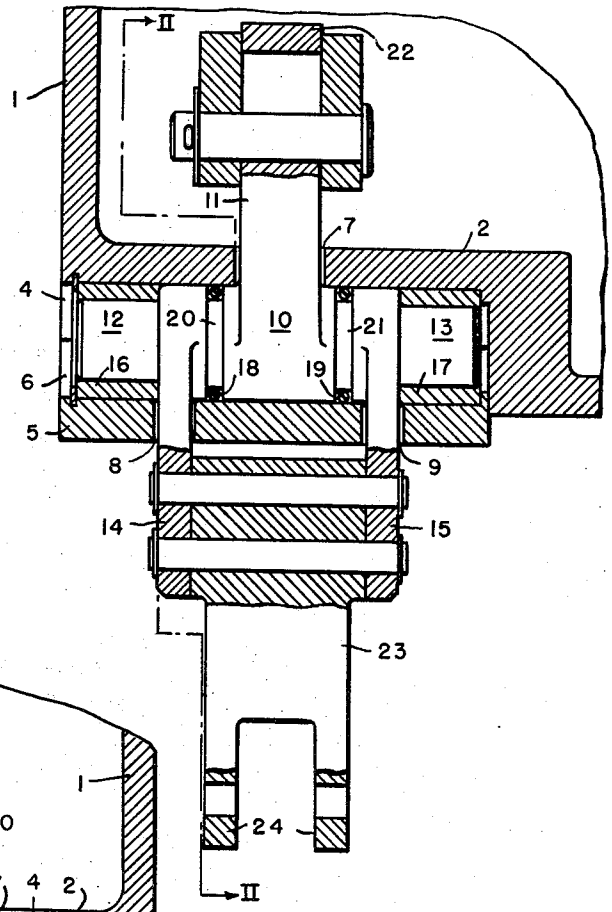


Fig.2.

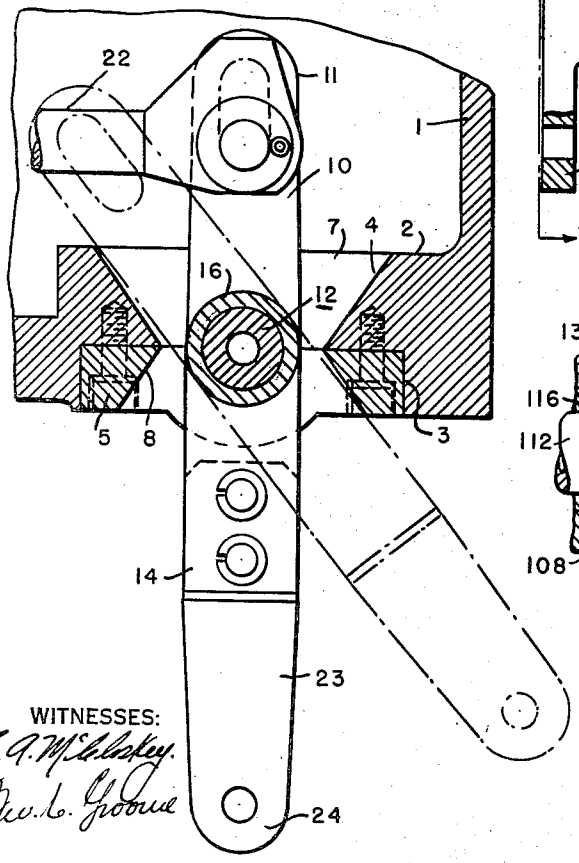
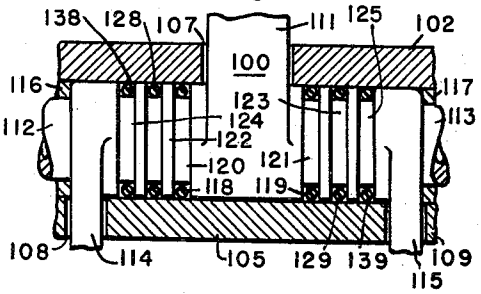


Fig.3.



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MECHANICAL LINKAGE WITH LIQUID SEALING MEANS

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4 Claims. (Cl. 74—519)

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Our invention relates to apparatus for transmitting motion of one member to some other member, and more particularly our invention is directed to a new type linkage, and liquid seal therefor, by means of which a force may be transmitted from an enclosure filled with liquid to the exterior of the enclosure without leakage of any liquid from the enclosure.

One broad object of our invention is the provision of means for transmitting a force acting on a member within an enclosure to a member outside of the enclosure without leakage of any fluid in the enclosure to the outside.

Another but somewhat more specific object of our invention is the provision of linkage means for transmitting a force acting in a given direction within an enclosure to the outside of the enclosure acting in the same plane without having any liquid in the enclosure leak from the enclosure at the bearings of the linkage means.

The objects recited are merely illustrative. Other objects and advantages will become readily apparent from a study of the following specification and the accompanying drawing, in which:

Figure 1 is a broken out portion of an enclosure, or receptacle, showing the linkage and bearing structure therefor in longitudinal section;

Fig. 2 is a view in section, along section line II—II of the subject matter shown in Fig. 1; and

Fig. 3 shows a modification of our invention with the bearing structure shown in section.

We are aware that devices for the purpose to which our invention is directed are well known in the prior art. Such devices usually include a bulky rubber diaphragm which is clamped around the neck of the link and the flange thereof is secured to the housing. In this most favored apparatus for the purpose the diaphragm flexes with each movement of the link. However, since apparatus for guided missiles require the use of oils in an enclosure that must remain at substantially the same viscosity for temperature variations from 40° below zero to 225° above zero, it is apparent that a requirement is placed on the diaphragm which it is not capable of satisfying. At one temperature extreme the diaphragm solidifies and breaks and at the other extreme it becomes so pliable and soft that it tears readily.

With our construction the sealing effect of the materials used is not noticeably affected by the changes in temperatures to which the guided missile is subjected during use and proper functioning of the apparatus within the guided missile is always obtained.

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In the figures of the drawing, 1 designates the tank, or enclosure. The enclosure, or receptacle, is provided with a table, or thickened, portion 2. This thickened portion of the side-wall is provided with a generally rectangular recess 3 which is provided longitudinally thereof with a semi-cylindrical bearing groove 4.

A cap 5 is designed to fit into the recess 3 and is provided longitudinally thereof with a semi-cylindrical bearing groove 6 of the same dimensions as bearing groove 4 and having a common axis with the bearing groove 4.

The side wall at the thickened portion and substantially at the middle of the cylindrical bearing formed by the bearing groove 4 and 6 is provided with a dove-tailed slot 7. The cap 5 is provided with two dove-tailed slots 8 and 9 disposed, respectively, near the ends of the bearing so that a cylindrical bearing surface of some axial length is provided between slots 8 and 7 and a similar cylindrical bearing surface of some axial length is provided between slots 7 and 9.

A movement transmitting link 10, having the projection 11, the stub shafts 12 and 13, and the projection 14 and 15, is so positioned that the projection 11 extends through the slot 7 and the projections 14 and 15 extend through slots 8 and 9, respectively. The link 10 may be constructed of a single forging, or casting, as shown, or of several parts.

In order to provide for an effective seal for the tank, provision must be made for a leak-proof seal at the cylindrical bearing surfaces falling, respectively, between slots 8 and 7 and slots 7 and 9. To accomplish the sealing action we provide the link with grooves 20 and 21 and into these grooves we position O-rings of rubber, nylon, or preferably neoprene, having a sectional diametrical dimension greater than the depth of the grooves 20 and 21.

In the assembly of the parts the stub shafts are provided with bearing sleeves 16 and 17 and then projection 11 is passed through slot 7 and then the cap 5 is moved over the projections 14 and 15 is then bolted in position as shown to firmly hold the bearing sleeves and to compress the O-rings 18 and 19 to effectively seal the slot 7 from the slots 8 and 9 and to thus effectively seal the tank against leakage.

To the inner end of projection 11 we adjustably secure the rod 22 and to the outwardly projecting ends of the projections 14 and 15, we secure the member 23 by suitable bolts or rivets as shown. An actuated member may be secured

to the member 23 at the bifurcations 24, or for that matter the member 23 may be considered either as the actuated member or the actuating member.

From the construction shown it will readily be apparent that the link 10 may be actuated through a total angle of about 70°, i. e., 35° to each side of the neutral position and that the force transmitted falls in the same plane as the force received.

In connection with some oils in the tank the prevention of oil leaks may be somewhat more difficult than normal. To still more effectively seal the tank we provide, in the modification shown in Fig. 3, the force transmitting link 103 with three grooves 120, 122 and 124 between the projections 114 and 111, and three similar grooves 121, 123 and 125 between the projections 111 and 115. Into these grooves we fit the O-rings 118, 128 and 138, and 119, 129 and 139.

These O-rings have a greater sectional diameter than the depth of the respective grooves into which they are positioned. The result is a very excellent seal for the tank.

In describing Fig. 3 it will be noted that the reference characters correspond to those used in Figs. 1 and 2, except that each is greater by one hundred. For example, reference characters 102, 105, 107, 108, 109, 112, 113, 116, 117, etc., correspond in the elements to which they refer to reference characters 2, 5, 7, 8, 9, 12, 13, 16, 17, etc.

While we have shown but a single embodiment of our invention, it will be understood that changes may be made in the arrangement and combination of the parts all within the scope of the appended claims without departing from the spirit of the invention.

We claim as our invention:

1. In apparatus for transmitting movement of a member in a receptacle adapted to contain a liquid to a member outside of the receptacle without leakage of any liquid from the receptacle, in combination, a receptacle adapted to contain a liquid, said receptacle being provided with a table on one inner surface of the receptacle and the table being provided near its mid-region with a dove-tailed slot with the flared end of the slot being directed inwardly, the outer surface of the receptacle below the table being provided with a recess, a covering plate bolted into the base of the table and filling said recess, a semi-cylindrical bearing groove in the outer surface of said recess and a similar bearing groove in the plate both arranged in axial alignment, cylindrical bearings in the corresponding ends of the bearing grooves, a shaft disposed to snugly fit in said bearings, a lever rigidly secured to the mid-region of the shaft and disposed to project into the receptacle through said dove-tailed slot in the table, a second lever rigidly secured to the shaft axially spaced from one side of the first lever, said cover plate being provided with an outwardly flaring dove-tailed groove for receiving the second lever so that the second lever projects beyond the outer surface of the cover plate, a liquid sealing ring disposed about the shaft and between the first and second levers and snugly fitting about the shaft and engaging the bearing grooves to thus effectively seal the liquid against leakage from the receptacle, an operating rod connected to the end of the first lever, and an operated rod connected to the end of the second lever.

2. In apparatus for transmitting movement of a member in a receptacle adapted to contain a liquid to a member outside of the receptacle without leakage of any liquid from the receptacle, in combination, a receptacle adapted to contain a liquid, said receptacle being provided with a table on one inner surface of the receptacle and the table being provided near its mid-region with a dove-tailed slot with the flared end of the slot being directed inwardly, the outer surface of the receptacle below the table being provided with a recess, a covering plate bolted into the base of the table and filling said recess, a semi-cylindrical bearing groove in the outer surface of said recess and a similar bearing groove in the plate both arranged in axial alignment, cylindrical bearings in the corresponding ends of the bearing grooves, a shaft disposed to snugly fit in said bearings, a lever rigidly secured to the mid-region of the shaft and disposed to project into the receptacle through said dove-tailed slot in the table, a second lever rigidly secured to the shaft axially spaced from one side of the first lever, a third lever rigidly secured to the shaft axially spaced from the other side of the first lever, said cover plate being provided with an outwardly flaring dove-tailed groove for receiving the second lever so that the second lever projects beyond the outer surface of the cover plate, a liquid sealing ring disposed about the shaft and between the first and second levers and snugly fitting about the shaft and engaging the bearing grooves to thus effectively seal the liquid against leakage from the receptacle, said cover plate being provided with an outwardly flaring dove-tailed groove for receiving the third lever so that the third lever projects beyond the outer surface of the cover plate, a liquid sealing ring disposed about the shaft and between the first lever and third lever and snugly fitting about the shaft and engaging the bearing grooves to thus effectively seal the liquid against leakage from the receptacle, an operating rod connected to the end of the first lever, and an operated rod connected to the end of the second and third levers.

3. In apparatus for a guided missile having a sealed receptacle and including apparatus for transmitting movement from a member in the receptacle to a member outside of the receptacle, in combination, a receptacle having a relatively thick side-wall, a bearing in the side-wall having four axially aligned axially spaced cylindrical bearing surfaces, a shaft disposed to snugly fit into the bearing surfaces, liquid seals disposed in the bearing surfaces disposed between the two outer bearing surfaces, a projection rigidly secured to the shaft and projecting inwardly through a dove-tailed slot in the side-wall between the two middle bearing surfaces, a pair of projections rigidly secured to the shaft, one projecting outwardlly through a dove-tailed slot in the side-wall between one end bearing surface and the proximate bearing surface, and the other projecting outwardly through a dove-tailed slot in the side-wall between the other end bearing surface and the bearing surface proximate to this said other end bearing surface, and means for operating said shaft through said projections.

4. In apparatus for transmitting motion from the inside of a tank in a guided missile adapted to contain a liquid to the outside of the tank, in combination, a tank, a plurality of axially aligned and axially spaced cylindrical bearing surfaces in side-wall of the tank, a shaft in the bearing surfaces, said shaft being provided with oppositely projecting levers, one projecting into the tank through a dove-tailed slot in the inner surface of the side-wall to the axis of the bearing surfaces,

the other lever projecting out of the tank through a dove-tailed slot in the outer surface of the sidewall to the axis of the bearing surfaces, said projections being axially spaced along the shaft so that one bearing surface is disposed about the shaft between the projections, a liquid seal disposed about the shaft and in the bearing surface between the projections, an actuated member at one end of one projection, and an actuating member at the end of the other projection.

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