March 23, 1954 L. A. THOMSON ET AL 2,672,823

ROTARY PUMP

Filed Jan. 12, 1948 3 Sheets-Sheet 1

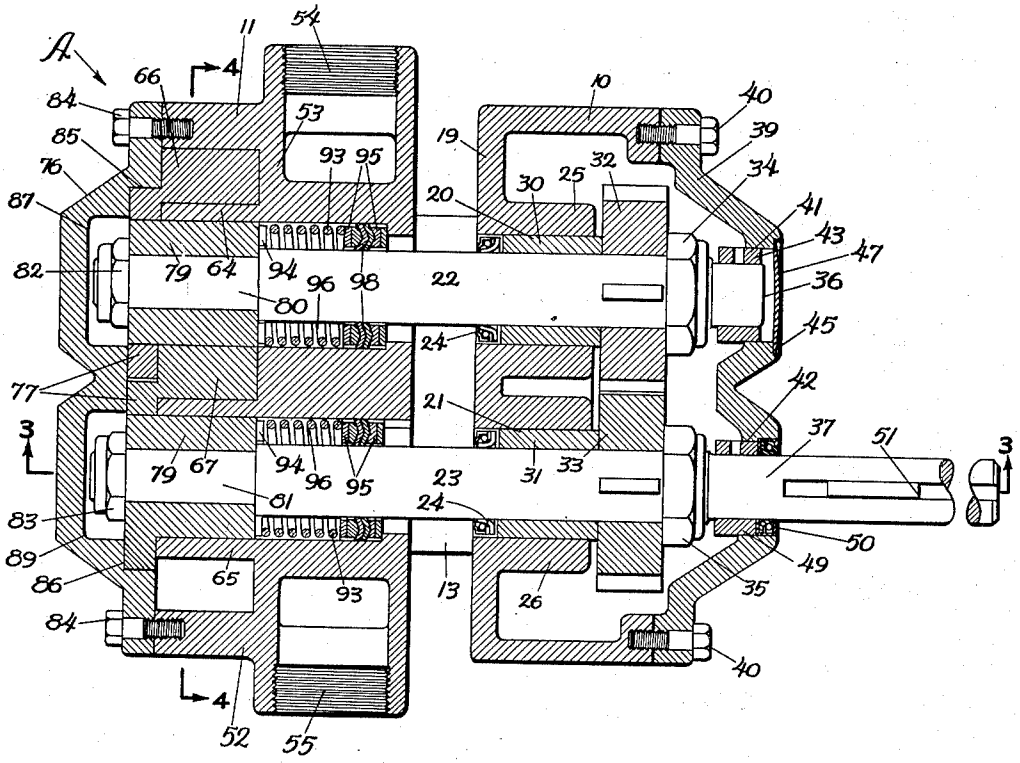


Fig. 2

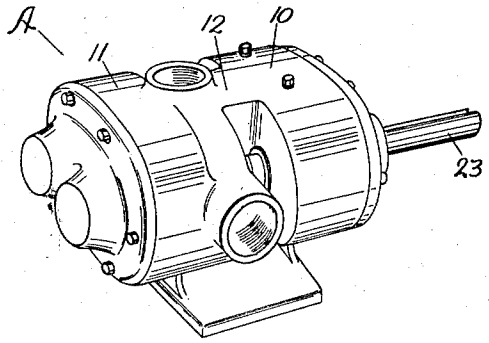


Fig. 1

Inventor
Leroy A. Thomson and
David F. Thomas
By Robert M. Dunning

March 23, 1954 L. A. THOMSON ET AL 2,672,823

ROTARY PUMP

Filed Jan. 12, 1948 3 Sheets-Sheet 2

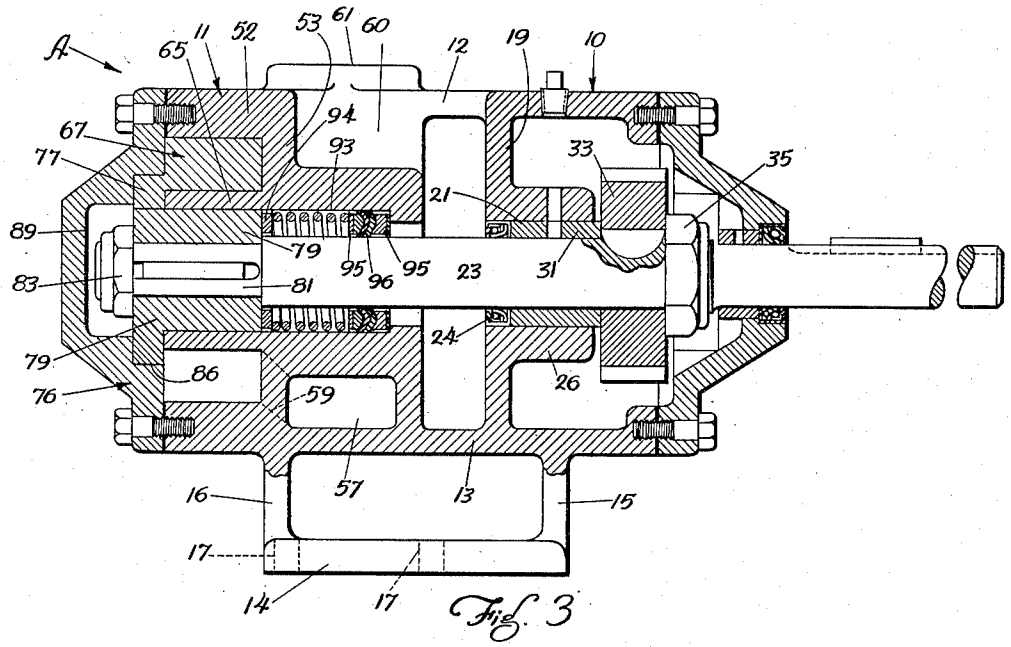


Fig. 3

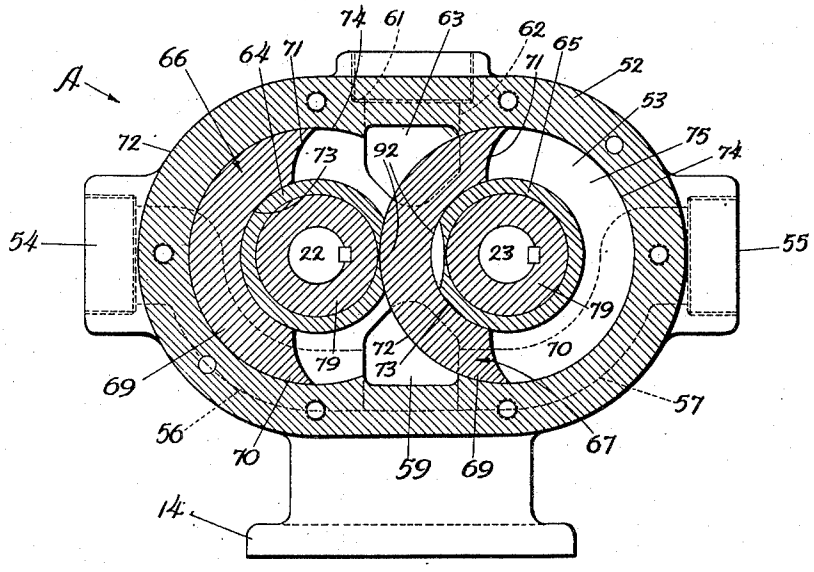


Fig. 4

Inventor

Leroy A. Thomson and

David F. Thomas

By Robert M. Dunning

March 23, 1954 L. A. THOMSON ET AL 2,672,823

ROTARY PUMP

Filed Jan. 12, 1948 3 Sheets-Sheet 3

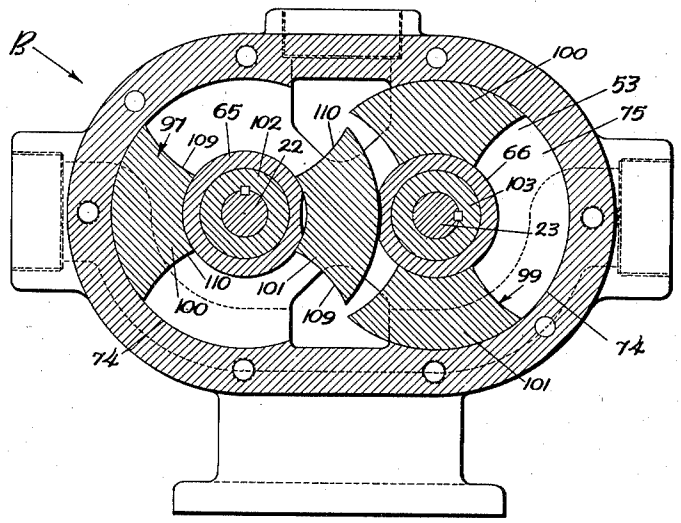


Fig. 5

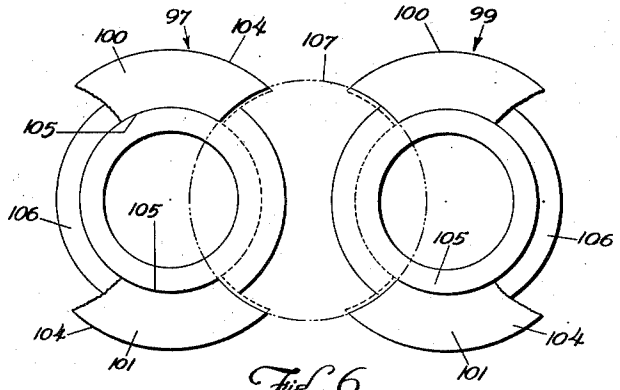


Fig. 6

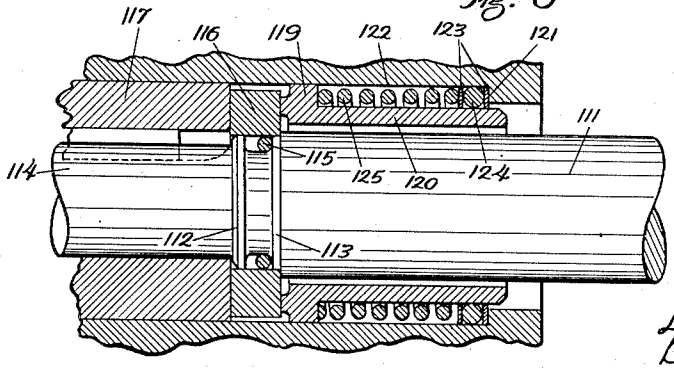


Fig. 7

Inventor
Leroy A. Thomson and
David F. Thomas

By Robert M. Dunning

Patented Mar. 23, 1954

2,672,823

UNITED STATES PATENT OFFICE

2,672,823

ROTARY PUMP

Leroy A. Thomson and David F. Thomas, Minneapolis, Minn., assignors to Waterous Company, St. Paul, Minn.

Application January 12, 1948, Serial No. 1,723

4 Claims. (Cl. 103—126)

1

The present invention relates to an improvement in rotary pumps of a type particularly useful in pumping liquids and semi-liquids.

Various types of rotary pumps have been designed for handling semi-liquid materials or liquids containing solids. Such pumps are often used in conjunction with chemicals, foods of various types, soap, pharmaceuticals, oils, and the like. As a result the pumps must be designed so that they may be used in pumping liquids which contain solids such as pulpy matter, cubes and other such materials. The object of the present invention lies in the provision of a rotary pump which may be used for the pumping of such materials, and which would not be injured by foreign matter in the liquid pumped such as matches, pins, string and the like.

A feature of the present invention lies in the provision of a pump having a pair of inter-acting impellers which are mounted on hubs providing a bearing support directly under the rotor load. As a result the impellers are better supported to operate at slow speed without vibration or agitation.

A feature of the present invention resides in the provision of a pump having a pair of rotors provided with inwardly extending hubs which engage against a sealing device supported within the housing. The sealing means providing a seal between the impeller shaft and the casing is spaced substantially from the food chamber so that there is little danger of contaminating the material pumped with metal particles produced by the rubbing contact between two relatively movable parts.

A feature of the present invention lies in the provision of dual ports which may be connected either to the intake or to the outlet passage of the pump depending upon the direction of rotation of the impellers. When the impellers rotate in one direction, the dual ports are connected to the inlet of the impeller chamber, while rotation of the impellers in the opposite direction provides dual ports connected to the discharge from the impeller chamber.

An added feature of the present invention lies in the manner in which the impellers are constructed. Two impellers may be simultaneously machined with a single tool, thus saving time in the manufacture of the pump and insuring proper machining of cooperating impellers.

These and other objects and novel features of the invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a perspective view of the pump showing the outward appearance thereof.

2

Figure 2 is a cross sectional view through the parallel impellers and impeller shafts.

Figure 3 is a sectional view through one of the impellers of the pump, the position of the section being indicated by the line 3—3 of Figure 2.

Figure 4 is a cross sectional view through the pump, the position of the section being indicated by the line 4—4 of Figure 2.

Figure 5 is a view similar to Figure 4 showing two lobe impellers used in place of the single lobe impellers of Figure 4.

Figure 6 is a diagrammatic view showing a stage in the process of manufacturing the impellers shown in Figure 5.

Figure 7 is a sectional view through a portion of the pump casing adjacent an impeller hub showing a somewhat different type of packing construction from that shown in the previously described views.

The pump A illustrated in Figures 1 through 4 of the drawings includes an elongated body including a gear case portion 10 and an impeller housing portion 11 integrally or detachably connected by spacing arms 12 and 13. A base plate 14 likewise forms a connection between the two parts 10 and 11 by providing a flange 15 at one end thereof connected to the body portion 10 and a flange 16 at the other end thereof connected to the body portion 11. The base plate 14 is provided with suitable apertures 17 therethrough by means of which the casing or housing may be secured in fixed position.

The housing portion 10 includes a casing wall 19 having a pair of apertures 20 and 21 therethrough in spaced relation through which the impeller shafts 22 and 23 extend. The apertures 20 and 21 are somewhat larger than the outer diameter of the shafts 22 and 23 and oil seals 24 are interposed between the shafts and the housing at these points.

Hubs 25 and 26 are provided on the wall 19 encircling the apertures 20 and 21. The apertures 20 and 21 extend through these sleeves 25 and 26. Bearing sleeves 30 and 31 are provided in the apertures 27 and 29 respectively. The shafts 22 and 23 fit snugly within these bearing sleeves and are sufficiently free to rotate.

Gears 32 and 33 are keyed to the shafts 22 and 23 outwardly of the bearings 30 and 31. These gears are held in place by nuts 34 and 35 which engage externally threaded portions of the shafts 22 and 23. Smaller diameter portions 36 and 37 of the shafts 22 and 23 project beyond the threaded portions of these shafts.

A housing closure plate 39 is secured to the end of the housing portion 10 opposite the wall 19 by cap screws 40 or other suitable means. Spaced apertures 41 and 42 extend through the closure

plate 39. A bearing 43 is provided within the aperture 41 for accommodating the reduced diameter end portion 36 of the shaft 22. A circular aperture 45 of larger diameter than the aperture 41 is provided in the exterior surface of the plate 39 in alignment with the apertures 41 and 44. A plug 47 of steel or other suitable material is provided in the aperture 45 to enclose the end of the shaft 22.

A bearing 49 is positioned in the aperture 42 and an oil seal 50 is positioned in the aperture 42 outwardly of the bearing. The reduced diameter end 37 of the shaft 23 projects through the closure plate 39 and is provided with a splined end or provided with a key way 51 for accommodation of a suitable key for connecting the shaft to a drive element.

Thus it will be seen that the gears which connect the shafts 22 and 23 and which cause rotation thereof in unison are sealed within the gear chamber 10 and suitable lubricant may be placed in this chamber for lubricating the gears. This lubricant is spaced from the pumping chamber and there is virtually no danger of the lubricant entering this pump chamber.

The pump housing 11 includes a peripheral wall 52 which is closed on one end by an integral closure wall 53, as best illustrated in Figure 3 of the drawings. This wall 53 is of varying thickness, being relatively thin near its upper extremity as illustrated in this figure and being substantially thicker throughout the sides and lower portion thereof.

As illustrated in Figure 4 of the drawings a pair of oppositely disposed ports 54 and 55 are provided in the wall 52 on opposite sides of the casing. These ports 54 and 55 lead to cored passages 56 and 57, respectively, which communicate with a forwardly extending port 59 leading into the interior of the impeller housing, as shown in Figure 5 of the drawings. The central upper portion of the wall 53 is also thickened as indicated at 60 and a port 61 on the top of the housing communicates with a downwardly extending passage 62 terminating in a forwardly extending cored passage 63 leading into the impeller chamber. When the impellers rotate in one direction the passage 59 acts as the intake and the passage 63 acts as the outlet. When the direction of rotation of the impellers is reversed, the passage 63 acts as the inlet and the passage 59 acts as the outlet.

The wall 53 is provided with two forwardly extending integral sleeves or hollow bosses 64 and 65. The impellers 66 and 67 rotate about these sleeves 64 and 65. The impellers are similarly constructed and are shaped as best illustrated in Figure 4 of the drawings. Each impeller includes a generally semi-cylindrical piston 69 having arcuate ends 70 and 71. The semi-cylindrical pistons 69 are provided with concentric outer and inner cylindrical surfaces 72 and 73. The outer surface 72 is of proper diameter to fit with a running fit within the cylindrical inner surface 74 of the impeller chamber 75. One such cylindrical inner surface 74 is provided for each of the impellers 66 and 67.

The inner cylindrical surface 73 of each piston 69 is of proper diameter to fit with a running fit about the outer surface of a sleeve 64 or 65. The piston also is of proper depth to fit closely adjacent the outer surface of the wall 53 and against the closure plate 76. Thus the pistons 69 substantially fill a portion of the impeller chamber as they rotate.

The pistons 69 are supported upon supporting discs 77 which are secured marginally to the pistons. Each disc 77 is attached to a sleeve or hub 79. This sleeve or hub 79 fits upon a reduced diameter end of its respective shaft 22 or 23 and is keyed thereto to rotate therewith. The impeller 66 is mounted upon the reduced diameter end 80 of the shaft 22 while the impeller 67 is secured to the reduced diameter end 81 of the shaft 23. The impeller hubs 79 abut against shoulders in the shafts formed between the reduced diameter ends thereof and the remainder of the shafts. The shafts are provided with threaded ends to accommodate nuts 82 and 83 which hold the impellers in place.

The closure plate 76 is secured to the peripheral wall 52 of the pump housing by cap screws 84 or other suitable means. The closure plate is provided with two adjacent circular apertures 85 and 86 to accommodate the discs 77 of the impellers. The closure plate 76 is likewise provided with recesses 87 and 89 aligned with the apertures 85 and 86 to accommodate the nuts 82 and 83.

As is common in pumps of this type the sleeves 64 and 65 are notched on one side as indicated at 92 on the same radii as the housing surfaces 74 so that the impellers may fit closely together. The impellers are so timed that the piston of one impeller follows closely the piston of the other impeller in the rotation thereof. Thus the space between the impellers is at all times sealed, while liquid or partial liquid may be carried about the periphery of the impeller chamber by the piston from the inlet to the outlet.

An aperture 93 is provided in the wall 53 encircling each of the shafts 22 and 23. A seal is provided between the hub 79 of each impeller and the base or shoulder ends of the apertures 93. As best illustrated in Figures 2 and 3 of the drawings, a collar 94 encircles each shaft adjacent the impeller hub 79 and in surface contact therewith. A packing is provided at the base or shoulder end of each aperture 93. Each packing includes cooperable male and female adapter rings 95 having special leather packing washers 98, V-shaped in section therebetween. A spring 96 is interposed between the male adapter 95 and the collar 94. Thus the packing is urged against the base of each aperture 93 to seal the casing relative to the rotating shaft. The collars 94 fit against the ends of the hubs 79 and normally are held from rotation by suitable key pins or the like while the hubs rotate.

In Figure 5 of the drawings we illustrate a modified form of construction which is indicated in general by the letter B. The pump B is virtually identical to the previously described pump A with the exception that the pump B is provided with two-lobe impellers or two piston impellers rather than single piston impellers. The double lobed impellers are preferable where high speeds are required because of the fact that the lobes balance one another and do not exert as great a strain on the supporting shafts.

In the construction shown in Figure 5, the pump housing may be considered identical to that previously described. Sleeves 65 and 66 project from the housing wall 53 concentric with the cylindrical inner surfaces 74 of the impeller chamber 75. The impellers 97 and 99 are provided with two pistons or lobes 100 and 101 projecting from opposite sides of the supporting discs. The impellers are provided with hubs 102

and 103 which are supported on the shafts 22 and 23. In the pump B the pistons 100 and 101 are of an arcuate length equal substantially to one-fourth the circumference of a cylinder and are provided with arcuate ends so that the trailing edge of one lobe may fit closely adjacent the leading edge of a lobe of the other impeller in the rotation thereof.

In Figure 6 of the drawings is disclosed a manner in which the impellers 97 and 99 are machined so that two impellers may be simultaneously produced. Each impeller is first turned in a suitable machine to provide cylindrical outer surfaces 104 on the lobes and concentric inner cylindrical surfaces 105 thereupon. The outer and inner surfaces of the impellers are also turned to produce the proper impeller thickness and the discs 106 are machined to the proper size and shape.

Two impellers such as 97 and 99 are then secured in parallel relationship as indicated in Figure 6 and a boring cutter or tool 107 is used to produce the arcuate ends 109 and 110 on the pistons. This boring cutter 107 is positioned to simultaneously produce arcuate ends on one end of all four pistons simultaneously. The position of the impellers is then reversed and the boring tool 107 is again used to simultaneously form arcuate surfaces on the other ends of all of the pistons.

In Figure 7 of the drawings we disclose a modified form of seal. This form of seal is designed to take the place of that previously described in conjunction with the pump A. In this form of seal the shafts 111 are provided with a pair of spaced flanges 112 and 113 at the end of the reduced diameter portion 114 thereof. An O ring 115 is placed between the flanges 112 and 113. This O ring comprises a ring of rubber or other suitable material which is compressed between the shaft 114 and the inner surface of a collar 116. This collar 116 abuts against the impeller hub 117 on one side and against a second collar 119 on its opposite side.

A sleeve 120 freely encircles the shaft 111 and is integral with the collar 119. A shoulder 121 between two different diameter portions of the apertures 122 is provided outwardly of the sleeve 120. A pair of washers 123 having an O ring or rubber packing ring 124 therebetween encircles the sleeve 120 adjacent the shoulder 121. A spring 125 is provided between one washer 123 and the collar 119.

In operation the collar 116 rotates with the shaft and the hub 117. The collar 119 is keyed to or otherwise held from rotation relative to the housing of the pump. A running seal is provided between the collars 116 and 119.

In a pump of the type described it is important that the various parts coming in contact with the food or other material being pumped be accessible for cleaning purposes. It will be noted that the closure plate 76 may be removed by removing the cap screws 84. If preferred these cap screws may comprise wing nuts for easier removal. By loosening the nuts 82 and 83 the impellers may be removed from their respective shafts. The compression of the springs 96 then tends to force the collars 94 outwardly. If desired the entire seal may be removed. Thus in cleaning the pump, it is necessary to remove but an extremely small number of parts so that the pump may be easily dismantled and assembled.

In accordance with the patent statutes, we have described the principles of construction and operation of our rotary pump, and while it has been endeavored to set forth the best embodiments thereof, it is desired to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of the present invention.

We claim:

1. In a rotary pump, a housing, an impeller chamber in said housing, a pair of hollow bosses on said housing extending into said chamber in spaced relation, a pair of shafts extending through said hollow bosses and spaced therefrom, impellers mounted upon said shafts, said impellers including a hub interposed between each shaft and the corresponding boss for that shaft, a disc secured to said hub at one end thereof, and a segmental piston marginally secured to said disc, each said piston having a cylindrical inner surface fitting closely about its corresponding boss, the hollow bosses extending beyond the impeller hubs and having a shoulder therein spaced from the hubs, and a seal interposed between each said shoulder and a corresponding hub, said bosses supporting said hubs with a running fit to provide a bearing therefor, this bearing forming the sole support for said shafts within said housing.

2. The structure described in claim 1 and in which the housing includes recesses axially aligned with said shafts and encircling the same, and impeller retaining means on said shafts within, and in spaced relation to, the walls of said recesses.

3. A pump seal for use in a rotary pump having an impeller hub, a housing boss having a hollow passage therethrough serving as a bearing for the hub, and a shoulder within said boss spaced from said hub, the seal including a resilient ring encircling said shaft and held from longitudinal movement thereon, a collar encircling said resilient ring and abutting against an end of the hub, a second collar engaging the side of the first named collar opposite that abutting the hub, and spring means interposed between said shoulder and said second collar.

4. The structure defined in claim 3 and including packing means between said spring means and the said shoulder.

LEROY A. THOMSON.
DAVID F. THOMAS.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
628,906	Grindrod	July 11, 1899
1,497,050	Wardwell	June 10, 1924
1,642,454	Malmstrom	Sept. 13, 1927
1,853,430	Jensen	Apr. 12, 1932
1,877,688	Peterson	Sept. 13, 1932
1,891,612	Schmidt	Dec. 20, 1932
1,902,347	Vogt et al.	Mar. 21, 1933
2,096,490	Hansen	Oct. 19, 1937
2,161,729	Thomson	June 6, 1939
2,193,273	Dietzel	Mar. 12, 1940
2,228,933	Thomson	Jan. 14, 1941
2,247,454	Thomson	July 1, 1941
2,269,200	Hillner	Jan. 6, 1942
2,279,136	Funk	Apr. 7, 1942
2,372,816	Deschamps et al.	Apr. 3, 1945

FOREIGN PATENTS

Number	Country	Date
2,572	Great Britain	of 1868