April 7, 1936. G. B. VROOM 2,036,308

MEANS FOR PACKING MOVABLE MEMBERS

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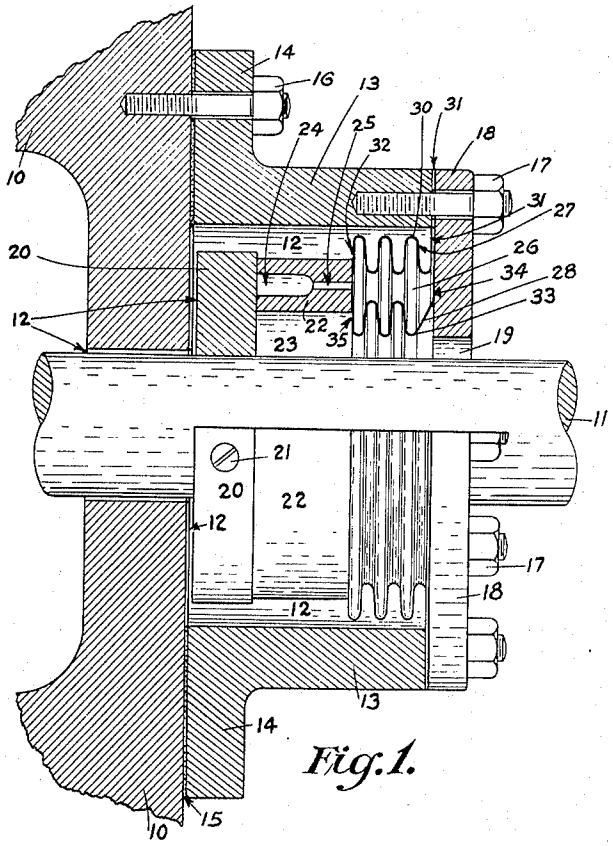


Fig. 1.

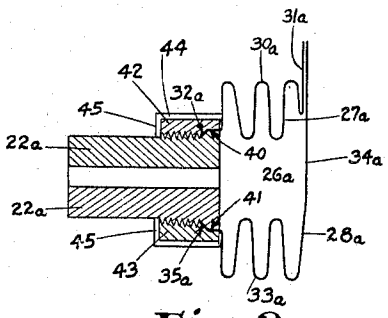


Fig. 2.

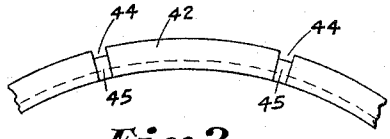


Fig. 3.



Fig. 4.

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MEANS FOR PACKING MOVABLE MEMBERS

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14 Claims. (Cl. 286—11)

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My present invention relates to the method of and means for packing movable members best adapted for use with a rotary shaft or other movable member, and it more particularly relates to such method and means when used where high pressure or vacuum may occur and tight, leak-proof connections are required for the associated rotary or other movable members, as in turbines, rotary pumps, compressors, and other mechanism which may employ steam, or any gas or their products.

More particularly, my present invention is an improvement upon and a continuation in part of my pending application Serial Number 33,566 in which the tension of a spring functions in yieldingly sealing the medium from escapement, and a single web of bellows-formed metal yieldingly connects and seals the sealing member with the apparatus; while my present apparatus dispenses with any such spring, and employs a bellows-formed metallic container to yieldingly connect and seal the sealing member with the apparatus, into which said container the escaping medium enters only through the sealed joint and expands said container, by the force of said escaping medium therein, thereby causing said sealing member to more tightly and perfectly seal said medium from escapement by the force of said escaped medium. Thus, in my present invention from its apparatus aspect, the double bellows-formed metallic walls form a double or cellular yielding seal between the relatively stationary apparatus and the movable sealing member, as well as perform the additional function of thrusting and maintaining said sealing member into tighter and more perfect sealing engagement by the force of the medium which has escaped only through the sealed joint into the chamber or cell between said double walls. When the pressure in said chamber or cell between said double bellows-formed walls drops substantially below the point where the seal is efficiently maintained, due to the condensation, heat transfer, loss or otherwise, of the medium, additional medium escapes only through the sealed joint into said compartment or cell and re-establishes the efficiency of said seal.

In its method aspect my present invention may be said to include the steps of providing a plurality of sealing stations in the area of the joint between the contacting surfaces of working and relatively stationary means, permitting a medium to escape to and from the initial one and into the other or last one of said stations, and sealing said joint into and out of each of said stations by a function of said escaped medium; while in an extended sense said method will include the additional step of permitting further said escapes to each of said stations as said function thereat subsides to re-establish said function and said sealing of said joint at each of said stations; and in the most economical and practical sense said method may be said to include the qualification that each escape of said medium to said first station will be limited to a relatively small volume of said medium, that the sealed medium is passed through an orifice to a supplemental volume to which the entrance to said joint is exposed, and which volume is juxtaposed to, and separated from, the medium in the other or final one of said stations, and that a heat transfer occurs from the high pressure medium in said supplemental volume to the volume of the escaped medium in said other or final one of said stations in order to prolong the efficiency of the thus sealed joint although less of the escaping medium is thereby admitted to the last stated station. In its aspects of lesser breadth it may be said of my method that the function of said medium which seals said joint is the pressure of said escaped medium; and that each of said escapes of said medium is limited to a relatively small volume of said medium; and that each of said escapes is progressive; and that each of said sealings of said joint may be intermittent; and that the available path of admission to and exit of the escapable medium from each of said stations comprises the path extending substantially around the shaft and within the area of the contacting surfaces sealing the joint.

The object of my invention is to provide such method in each of its said, and other, aspects, as well as to provide means which will demonstrate the simplicity, efficiency, practicability and usefulness of said method and the durable economy and simplicity of the preferred means I have devised for the preferred practice of my method; and from which those skilled in the art will be able to readily adapt many other forms of mechanism to the practice of my said method in each of its aspects and steps.

Having now indicated the objects of my present invention and the method and steps thereof by which my invention may be practiced, I will now proceed to describe the apparatus in one of the best and most practicable forms which I have devised for rendering my method and its steps most useful, reference being had to the

accompanying drawing, in which like characters of reference indicate the same parts, and wherein

Figure 1 is a plan view in partial section of an apparatus embodying my invention;

Figures 2, 3, and 4 are enlarged views illustrating details of construction thereof.

In Figure 1 of said drawing, 10 represents a casing of the working means which contains a medium under pressure whose escape through the working joint therein it is primarily desired to limit. 11 represents the working member which is, in the instance shown, a shaft of the type that performs its work by rotating, such as in turbines, rotary compressors, pumps, or the like. Surrounding shaft 11 is the inlet orifice extending through the wall 10 and leading to an escape passage 12 adapted to permit the escape through said orifice of a limited volume of the medium confined by said wall 10, and which medium may be steam, any gas, or the products thereof jointly or severally, and which medium is usually under pressure or vacuum, and for greater efficiency such pressure is usually high, or said wall 10 may enclose a substantial vacuum whose sealing is the primary object; and in either of said instances my invention functions with satisfactory efficiency, economy and durability.

Extending preferably from the outer surface of wall 10, and surrounding and at a relative distance from said joint 12, is an annular member 13 provided with an outer base flange 14 positioned against the outer surface of wall 10 directly, or indirectly through a thin gasket 15, to form a tight joint therebetween, and secured to wall 10 by bolts 16, or other securing means. Upon the outer end of member 13 is secured by bolts or other securing means 17 a closure disc 18 of such shape as to leave an escape passage 19 between said disc and shaft 11. A disc 20, preferably of steel is revoluble with and secured to shaft 11 by screw 21, or otherwise, at a point adjacent the outer surface of said wall 10 so as to form a continuation of said escape passage 12 for said medium between the adjacent surfaces of wall 10 and disc 20, while the relative external diameter of said disc 20 and the internal diameter of member 13 forms a further continuation of said escape passage 12 therebetween, and at each of said three stages of said escape passage 12 so formed the cross-sectional area of said passage in each of its successive stages is progressively increased to enable said escaping medium to expand as it progresses in the passage 12.

In gas and fluid tight contact with a portion of the outer lateral surface of disc 20 is the inner lateral face of a ring 22 whose outer diameter is substantially less than the inner diameter of member 13 so that the space therebetween forms a still further continuation of said escape passage 12 of still larger cross-sectional area than its adjacent preceding portion of said passage 12 about the periphery of disc 20; while the inner diameter of ring 22 is substantially larger than the diameter of shaft 11 so that there is formed therebetween an escape passage 23 for such of the said medium as may escape from said final expansion stage of escape passage 12 through the joint between said disc 20 and ring 22, said escape passage 23 being further provided with the escape outlet 19 to the atmosphere.

In order to increase the efficiency, when desired, of the joint between disc 20 and ring 22, I provide in the face of ring 22, contacting with disc 20, and extending through said ring, communicating passageways 24 and 25, which may extend completely around said ring and thus sever said ring into two separated rings, as shown in Fig. 2, or the same may extend through said ring at a plurality of points throughout its extent; the passageway 24 being relatively of larger cross-sectional area than said passageways 25, and the former extending from said face of said ring 22 in contact with said disc 20, and each of said passageways 24 and 25, especially the former, being closer to the outer edge of said ring 22, so that between said passageway 24 and the outer diameter of said ring 22 is a relatively thin surface of said ring 22 bearing against said disc 20 while between said passageway 25 and the inner diameter of said ring 22 is a substantially equal surface of said ring 22 bearing upon said disc 20.

Between the free lateral face of ring 22 and the inner surface of closure disc 18 is a thrust means 26 adapted to thrust ring 22 laterally against disc 20 to maintain the seal therebetween, said thrust means being adapted to act independently upon each of the inner and outer portions of said ring 22 when the same are separated by the continuity of passages 24 and 25 as is preferred for highest efficiency when sealing a vacuum or certain types and characteristics of pressure medium.

For economy, efficiency, durability and simplicity I prefer to actuate said thrust means 26 by a function of the escaping medium.

When sealing certain types and characteristics of medium I prefer to form said thrust means 26 in two juxtaposed parts 27 and 28 each of which may independently thrust its corresponding independent component part of ring 22 against said disc 20 in the performance of the sealing function.

When the function of the escaping medium which actuates said thrust means is the heat thereof said members 27 and 28 of said thrust means 26 function due to their coefficients of expansion, which in some uses afford more satisfactory results when said members 27 and 28 are formed of different metals or alloys having different coefficients of expansion so that under the heat differential to which said members are subjected their respective separated portions of ring 22 will each be thrust against disc 20 with substantially the same force, while in other uses said members 27 and 28 may have the same coefficients of expansion.

Moreover, when the function of the escaping medium which actuates said thrust means 26 is the pressure thereof, said means 26 functions as a receptacle for such of the medium as escapes through the joint between ring 22 and disc 20 into passageways 24 and 25, where the pressure of said medium there received thrusts ring 22 against disc 20 to increase the efficiency of the seal therebetween. When the pressure of the escaping medium confined in, or exerting its pressure upon, said thrust means 26 falls, due to condensation, heat transfer to the atmosphere, or otherwise, the thrust of ring 22 against disc 20 will become gradually less until the seal formed thereby is temporarily broken whereupon such liquid as may be in said means 26 or passageways 24 and 25 will escape from the lower side of said ring 22 and to the atmosphere through passageway 19 together with any

gaseous content thereof, while escaping medium from the adjacent expansion step of passageway 12 will pass through the joint between ring 22 and disc 20 to passageway 24 and thence through passageway 25 to said thrust means 26 where the pressure thereof will re-establish the normal thrusting and sealing efficiency of said means 26.

Whether said means 26 is actuated by the heat or pressure differential of the escaping medium its aforesaid path of travel is the same, and in certain uses and types of apparatus the same device may have its thrust means 26 actuated by either or both said heat and pressure differentials of said escaping medium should such interchangeability be desired.

The preferred form of the members 27 and 28 of thrust means 26, which I have found satisfactory in many instances of service, is obtained by constructing the same each of a single element which is adapted to substantial expansion and contraction as I have found the same less expensive, more durable and efficient than, for example, to construct each of the same of a plurality of pistons and co-operating cylinders to receive and be acted upon by said escaping medium to successively seal the joint between rotary disc 20 and non-rotating ring 22. In said preferred form said member 27 is constructed of a tube of metal having a plurality of corrugations 30 formed therein, each extending around said tube, with a flange 31 formed on the outer end of said tube, said flange 31 extending outward from said tube to the extent of the outer diameter of said member 13, while upon the inner end of said tube is formed a flange 32 adapted to fit against, and be secured by solder, brazing or otherwise to the adjacent end of the outer portion or member of ring 22. In said same form of apparatus said member 28 of thrust means 26 is formed of a tube of metal of substantially lesser diameter than the tube of which said member 27 is formed, and having a plurality of corrugations 33 formed therein about its periphery, with a flange 34 formed on the outer end of said tube and extending outward to, and conforming with, the outer diameter of said member 13, while upon the inner end of said tube is formed a flange 35 adapted to fit against, and to be secured by solder, brazing or otherwise, to the adjacent end of the inner portion or member of said ring 22; while said respective flanges 31 and 34 are clamped between the outer end of member 13 and the adjacent face of closure disc 18 by said bolts 17, or any other desired type of securing means to form a tight joint between said flanges 31 and 34 as well as between said member 13 and disc 18. Thus said corrugated members 27 and 28 form a gas and water tight receptacle completely around said ring 22 and extending between said ring and said disc 18, and the sole entrance to said receptacle being through said passageways 24 and 25.

An efficient and convenient means which I have found for attaching the members 27 and 28 to their respective portions or members of said ring 22, and which does not impair the stability and spring of the metal of which the same are formed by the heat of soldering and brazing, is as follows, reference being had to Figures 2 and 3, in which the same parts heretofore described are indicated by the same reference characters to which are added an exponent "a": Upon the inner and outer surfaces of said portions or members of ring 22a are formed conical or rounded shoulders 40 and 41 adapted to receive the flanges 32a and 35a of said respective members 27a and 28a, while respectively internally and externally threaded clamping rings 42 and 43 engaging threaded portions of their respective portions or members of ring 22a clamp their respective said flanges 32a and 35a to form a tight joint with said shoulders 40 and 41. Said rings 42 and 43 are respectively provided with longitudinal and radial slots 44 and 45 to receive a spanner-wrench with which said clamping rings may be tightened or released from their said clamping engagement.

The corrugated metal forming each of the members of the thrust means 26 performs the function of a spring in addition to sealing the medium from escape therethrough, and where slight pressures are employed said spring may be ample to seal said low pressure medium from escape through the joint between ring 22 and disc 20; but when any such escape occurs it reenforces the sealing thrust of said spring action. The spring action of each member of said thrust means 26, and the yielding thrust of the pressure of the escaped medium confined in and by each of said thrust means, compensates for any lateral play of rotating shaft 11, as well as for any wear of the parts.

In Figure 1 the sealing means 22 is formed integral. In its operation when sealing a pressure medium, such medium tends to escape through passageways 12 to the point where such medium contacts with the outer periphery of means 22 and 26. From this point the only possible path of escape of such medium is through the joint between means 22 and disc 20. However, the natural spring characteristics of means 26 tends to hold said joint sealed, and any temperature there may be in said medium is imparted to means 26 which tends to increase the sealing pressure of said joint. Should any of said medium escape through said joint, the whole or a portion thereof, will enter passageways 24 and 25 in said means 22 and into the closure between the elements of means 26 where the pressure and thermal characteristics of said medium will re-establish the efficiency of the seal between disc 20 and means 22.

In Figure 2 the sealing means 22a is formed of a plurality of separate elements or rings each separately secured to their respective independent elements of means 26a. In its operation it is similar to that described for Figure 1 except that when any of the sealed medium escapes through the joint between disc 20 and means 22 no part thereof can escape to the atmosphere since the inner element of means 22a seals the medium from escape to the atmosphere and compels the confining of such escaping medium in the space between the separate elements of each of the means 22a and 26a, where said medium restores the sealing efficiency of sealing means through which said medium escaped as well increases the sealing efficiency of the remaining adjacent sealing means. Such temperature characteristics, as are inherent in the medium tending to escape and juxtaposed to the medium which has escaped to and is confined between the separate separated elements of means 22a and 26a, are imparted by radiation to said confined medium and tends to increase and prolong the sealing efficiency of means 22a and 26a. The foregoing operation occurs periodically.

When the sealing efficiency of the outer or inner elements of sealing means 22*a* and 26*a*, due to their having one of their surfaces in contact with the atmosphere and its temperature and the condensation of said medium confined between the elements of means 22*a* and 26*a* or otherwise, said outer or inner element of means 22*a* unseals and permits the drainage therefrom of the condensation and said confined medium, during a part or all of which time of said escape the outer elements of means 22*a* and 26*a* may remain sealed against disc 20 due to the spring tension and temperature expansion of the outer element of means 26*a*.

The foregoing operation repeats itself substantially in the cycle above indicated, and such of the medium as tends to escape must, in order to escape to the atmosphere, escape only into the area of said joint between the contacting surfaces of collar 20 and ring 22 or 22*a* through successive sealing stations on different portions of the surface of disc 20, and at each of said sealing stations the medium tending to escape functions to increase the force with which collar 20 is contacted by the inner and outer portions of ring 22 or 22*a* and thus increase the sealing efficiency of each of said sealing stations.

From the foregoing and following description it will be appreciated that in my method the gases are in a number of important novel respects transformed and reduced to a different state.

In the prior art practice the gases escape to the atmosphere between the contacting surfaces of the sealing joint only or through an independent pathway in addition to said joint-escape.

In my improved method some of the substantial volume of high pressure medium to be sealed from escape is passed through the inlet orifice of opening 12, preferably of increasing width with the wider portion of opening 12 exposed to the inlet portion of the joint between the contacting surfaces of the sealing joint between collar 20 and ring 22 or 22*a*, and the outer surface of the thin corrugated tube 30 or 30*a* forming one wall of a portion of opening 12. The high pressure gas that flows through said orifice expands into opening 12, thence some gas escapes into the joint between collar 20 and the outer portion of ring 22 or 22*a*, thence, instead of escaping to the atmosphere through the joint between collar 20 and the inner portion of ring 22 or 22*a*, the thus escaped medium passes into the opening between the outer and inner portions of ring 22 or 22*a* and thence between the outer and inner tubes 30, 33 or 30*a*, 33*a* where it exerts its force between the corrugations of said tubes as well as against the outer end of the ring portions 22 or 22*a* to thrust the inner edges of said ring portions against the juxtaposed surface of collar 20 to increase and maintain the sealing efficiency. The thrusting efficiency of the gas between said corrugated tubes is prolonged by heat exchange from the high pressure gas in opening 12 through the thin wall of the outer tube 30 or 30*a* to the gas between tubes 30, 33 or 30*a*, 33*a*.

The only avenue of escape of the gas, or its condensate, from between tubes 30, 33 or 30*a*, 33*a*, is through the joint between collar 20 and the inner portion of ring 22 or 22*a*.

The leakage through the joint between collar 20 and the portions of ring 22 or 22*a* contacting therewith is relatively small, may be periodical, and tends to lubricate said joint.

It will be obvious that in sealing a vacuum with my invention the functions and steps are the reverse of those described for sealing a pressure medium, and that when my invention becomes familiar to those skilled in the art other variations thereof and many other forms of apparatus may be readily adapted to perform and practice my invention, and that such and other variations and equivalents thereof within the range of the appended claims are within the scope of my invention.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon or therefor.

Having now so fully described my invention that others skilled in the art may therefrom make and use the same, what I claim and desire to secure by Letters Patent is:

1. In a packing, a rotary and relatively stationary means having a joint therebetween, a collar tightly secured to the rotary means, a pair of separated concentric independently movable sealing rings each having one edge in contact with and adapted to be in sealing engagement with the same surface of said collar, and each having a supplemental ring threaded thereto with juxtaposed clamping surfaces between each sealing ring and its supplemental ring, said clamping surfaces being of increasing diameter toward the ends of said rings remote from the ends in contact with said collar, a corresponding plurality of bellows-folded tubes of different diameters each secured at one end between said clamping surfaces on its respective sealing ring, and means for securing the remaining end of each of said tubes to the relatively stationary element, the space between said rings and tubes being closed to all but the medium to be sealed by said packing, which medium is admitted to and from said space only by moderate progressive escape through said sealing engagement.

2. In a packing the combination of a sealing ring having a sealing edge, a supplemental ring threaded thereto, each of said rings having peripheral juxtaposed clamping surfaces between said threaded portions and their edges opposite said sealing edge, the clamping surface of said sealing ring comprising the surface of a projection of progressively increasing diameter toward the edge opposite said sealing edge, said clamping surface of said supplemental rings comprising a recess complementary to said projection, and a tube comprising a bellows-folded wall adapted to be secured at one end between said clamping surfaces.

3. In a packing, rotary and relatively stationary means having a joint therebetween, a plurality of separated, substantially concentric, circular, longitudinally and independently expandable sealing walls in and extending lengthwise across said joint and having at one end overlapping juxtaposed portions, means for securing said overlapping portions seal-tight to each other and to one of the first-named means, a ring sealed to the other end of each of said walls and adapted to slidingly engage a portion of the other one of the first-named means, there being a space between said walls and rings having no inlet or outlet except progressively between said slidingly engaged surfaces, there being some compression in each of said sealing walls exerted against their sealing rings, a portion of the medium to be sealed being in direct engage-

ment with one surface of one of said walls and periodically escape through said sliding engagement of its adjacent ring into the space between the walls, and the amount of which escaping medium is adapted to be limited by its action on said walls and rings increasing the pressure and sealing efficiency of the sliding engagement of said rings.

4. In a packing, a rotatable shaft, relatively stationary means adapted to confine a medium and through a wall of which the shaft is adapted to extend with a joint therebetween; a plurality of separated substantially concentric, circular, longitudinally and independently expandable walls in and extending lengthwise across said joint and having at one end overlapping juxtaposed portions; means for securing said overlapping portions sealed to the stationary means, a ring sealed to the free end of each of said walls and adapted to slidably engage a projection of said shaft in sealing engagement, there being a space between said rings in communication with the space between said separated walls and which spaces are without any outlet except through the slidable engagement of said rings, a portion of the medium to be sealed being in contact with one surface of one of said separated walls and periodically escape through said sliding engagement of its adjacent ring to the space between the walls, and which escaping amount is adapted to be limited by its action on said walls and rings increasing the pressure and sealing efficiency of said rings against said projection of said shaft.

5. In a packing, a rotatable shaft having a collar rigid therewith, relatively stationary means adapted to confine a medium and through a wall of which the shaft is adapted to extend with its collar juxtaposed to the exterior surface of said means and having an angular restricted space between the means and the shaft and collar, an annular housing extending about said shaft and collar and secured to said means, a cover adapted to be secured over the end of the housing and about the shaft, a plurality of bellows-folded tubes each of different diameters within said housing and extending about the shaft and sealed tight at one of their ends to said cover, a packing ring sealed to the free ends of said tubes and slidably engaging a lateral surface of said collar and provided with an opening extending from a point within the area of the sliding surface of the ring to between said tubes, the confined medium being adapted to periodically escape in limited amounts through the joint between the ring and collar and into the space between said tubes where its action increases the efficiency of the seal between the ring and collar.

6. In a packing, a rotatable shaft having a collar rigid therewith, relatively stationary means adapted to confine a medium and through a wall of which the shaft is adapted to extend with its collar juxtaposed to the exterior surface of said means and having an annular restricted space between the means and the shaft and collar, an annular housing extending about said shaft and collar and secured to said means, a cover adapted to be secured over the end of the housing and about the shaft, a plurality of annular adjacent tubes of different diameters provided with bellows-folds, and within said housing and extending about the shaft and sealed tight at one of their ends to said cover, a separate packing ring sealed to the free end of each of said tubes and in sliding sealing engagement with said collar, there being a communicating space between each pair of said rings and tubes and whose only inlets and outlets are through the sliding engagement of their respective packing rings with the collar, the confined medium being adapted to periodically escape in limited amounts through the said slidingly engaged surfaces and into the space between said rings and tubes where its action increases the pressure and the efficiency of the engagement of the seal between each ring and the collar.

7. The art and structure of claim 5 characterized by the outer edges of the tubes being extended outward with their terminal edges in the same plane and adapted to be sealed together and to the housing by being extended and clamped between said housing and its cover.

8. The art and structure of claim 6 characterized by the outer edges of each tube being extended outwardly and juxtaposed and adapted to be sealed together and to the housing when clamped between said housing and its cover, and means for removably securing said cover to the housing.

9. In a packing, the combination of means having a wall adapted to confine a medium and provided with an orifice extending therethrough, a shaft extending through said wall, a gas-tight collar on and revoluble with said shaft on the outer side of said wall, a housing on the outer side of said wall and inclosing said collar and having an annular space connected to said orifice and surrounding said collar; a ring surrounding said shaft and having a surface adapted to contact with a surface of said collar and seal the joint therebetween; means for supporting said ring laterally movably relative to said collar, for forming an enclosure on the outer side of said ring, and for sealing the medium in said annular space from escape except through said sealing joint; and said contacting surfaces having an opening within the area of their contact and leading through said ring into said enclosure; whereby some of the confined medium passes through the orifice to the annular space, thence a portion thereof passes only into the sealing joint, thence into the opening in the ring to the enclosure where it maintains the thrust of the ring against the collar in efficient sealing contact.

10. In a packing, the combination of means having a wall adapted to confine a medium and provided with an orifice extending therethrough, a shaft extending through said wall, a collar gas tight on and revoluble with said shaft on the outer side of said wall, a ring surrounding said shaft and having a surface adapted to contact with a surface of said collar and seal the joint therebetween; a diaphragm supporting said ring laterally movably relative to said collar; a housing on the outer-side of said wall and enclosing and having an annular space about said collar, ring and diaphragm, said space being connected to said orifice; means for sealing the medium from escape from said space except through the sealed joint; and said contacting surfaces having an opening within the area of their contact and leading through said ring and extending into said diaphragm; whereby some of the confined medium passes through the orifice to the annular space, thence a portion thereof passes only into the sealing joint, thence into said opening, and thence

within the diaphragm where it maintains the thrust of the ring against the collar in efficient sealing contact, and which thrust is prolonged by heat transfer through a wall of the diaphragm from the medium within the space to that within the diaphragm.

11. In a packing, the combination of means having a wall adapted to confine a medium, a shaft extending therethrough and having a collar gas tight on and revoluble with the shaft adjacent said wall, a ring surrounding said shaft and having a surface adapted to contact with a surface of said collar and seal the joint therebetween; means adapted to thrust the ring against the collar to maintain the seal of the joint; means whereby the only wastage of the confined medium is through said joint; and means for taking only medium after it has wasted into the joint and therewith actuating the first stated means; whereby only the medium in the act of normally wasting into the joint is used to maintain the seal of the joint and reduce said waste.

12. In a packing, the combination of means having a wall adapted to confine a medium, a shaft extending therethough and having a collar gas tight on and revoluble therewith adjacent said wall, a ring surrounding said shaft and having a surface adapted to contact with a surface of said collar and seal the joint therebetween; said contacting surfaces having a substantially annular opening therebetween within the area of their contact; a diaphragm fixed gas tight to said ring and having a passageway in constant communication with said opening; and means for non-revolubly supporting said diaphragm and preventing waste of the sealed medium except through said sealing joint; whereby only the sealed medium wasting into said joint actuates the diaphragm to maintain the seal of the joint and reduce said waste.

13. In a packing, the combination of claim 12 characterized by its ring being a plurality of separate concentric rings spaced apart and each having a surface adapted to contact with a surface of said collar and seal the joint therebetween and which space forms said opening.

14. In a packing, the combination of claim 12 characterized by its ring being two separate concentric rings spaced apart and each having a surface adapted to contact with a surface of said collar and seal the joint therebetween and which space forms said opening, and further characterized by said diaphragm being comprised of two separated portions fixed gas tight to their respective rings and by said passageway comprising the space between said portions.

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