No. 885,032. PATENTED APR. 21, 1908.

S. Z. DE FERRANTI.

FLUID PACKING.

APPLICATION FILED JUNE 24, 1907.

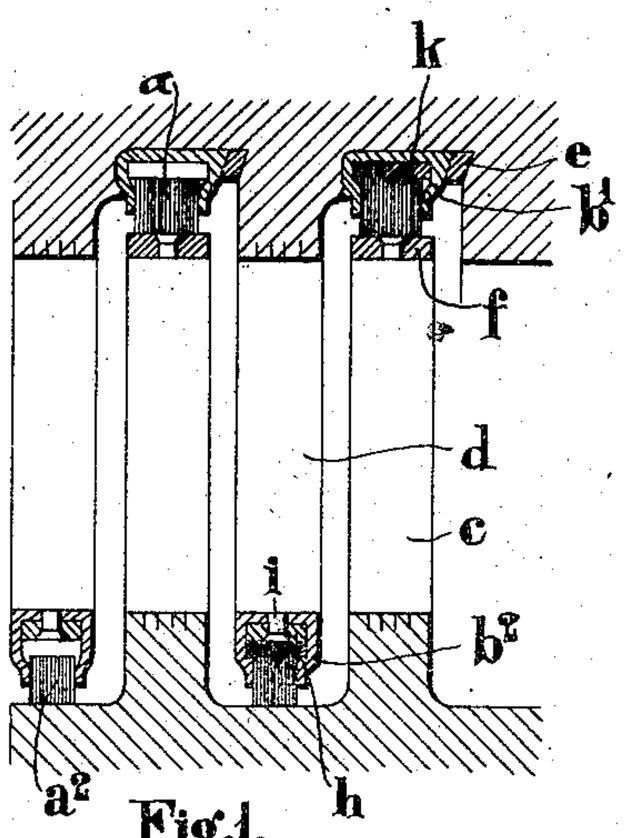

Fig.1.

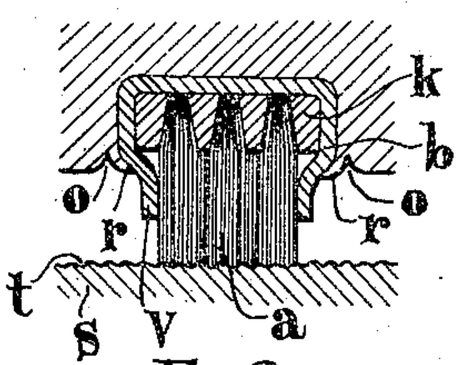

Fig.2.

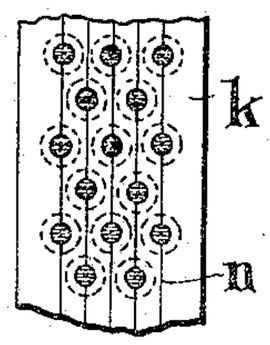

Fig.3.

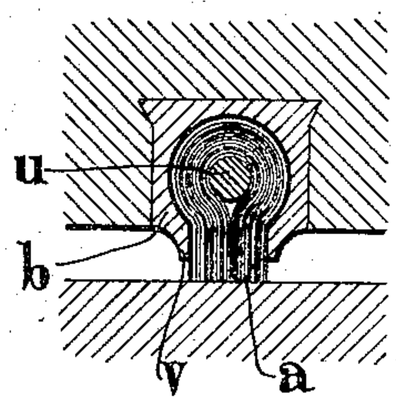

Fig.4.

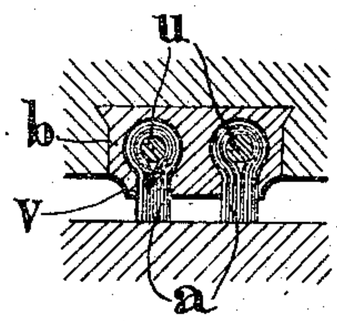

Fig.5.

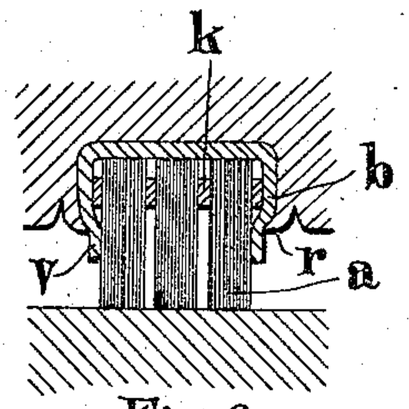

Fig.6.

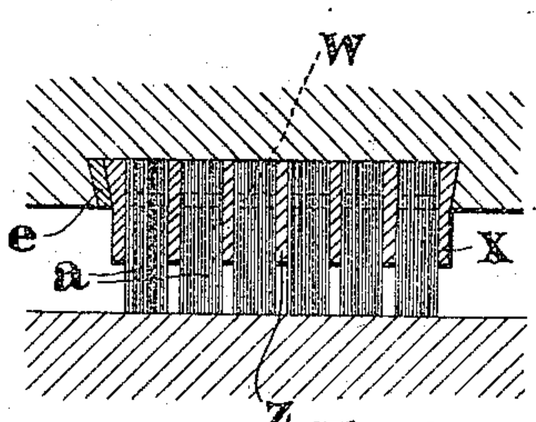

Fig.8.

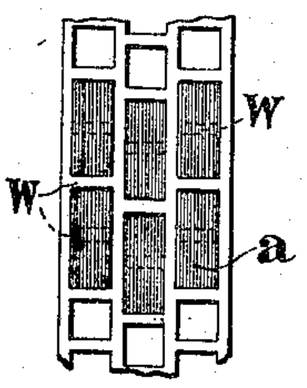

Fig.7.

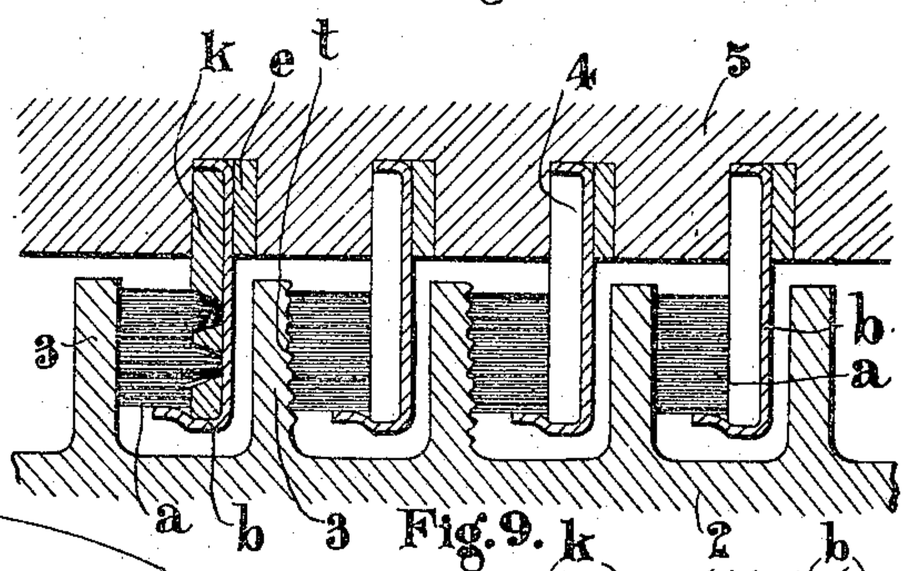

Fig.9.

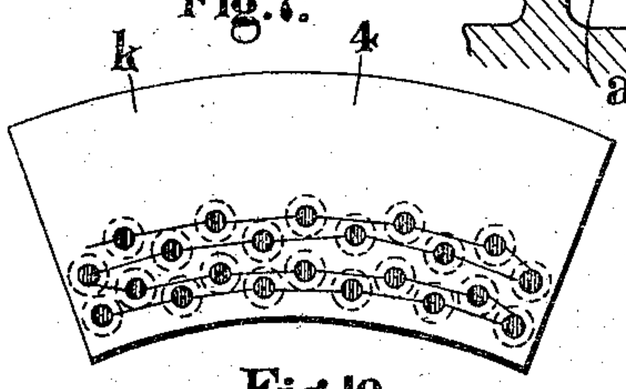

Fig.10.

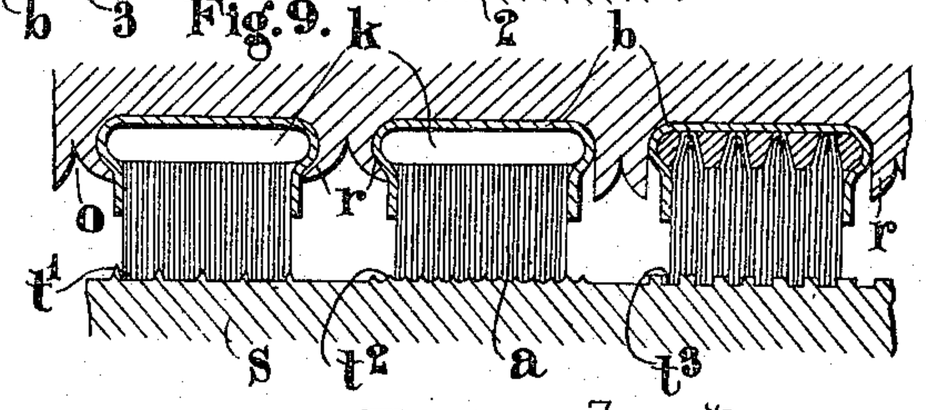

Fig.11.

Attest.

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UNITED STATES PATENT OFFICE.

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FLUID PACKING.

No. 885,032. Specification of Letters Patent. Patented April 21, 1908.

Application filed June 24, 1907. Serial No. 380,591.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, a subject of the King of Great Britain and Ireland, residing at Grindleford, in the county of Derby, England, having invented certain new and useful Improvements in Fluid Packing, of which the following is a specification.

My invention relates to fluid packings specially suitable for elastic fluid turbines and in such application has for its object to provide a packing which will prevent excessive leakage with increased range of pressure drop, and which will not be liable to cut or groove or otherwise injure the surface with which the packing contacts when sudden variations of the load causes "whip" of the shaft to take place.

My invention consists in the packings and applications of the same hereinafter claimed, certain examples of the invention being described in detail in order to enable those skilled in the art to carry the invention into effect.

Referring to the accompanying drawings which form part of the specification, Figure 1 shows generally the application of one form of my improved packing to the running and standing blades of a pressure flow turbine; Figs. 2 and 3 show cross section and part plan respectively of a form of the invention in which the brushes are wired in place in groups; Figs. 4 and 5 show forms in which the brush wires are bent over one or more central wires; Figs. 6 and 7 show cross section and part plan respectively of a modification in which a base strip having rectangular holes is adopted. Fig. 8 being similar but with base strip and holding ring combined into a single member; Fig. 9 shows one method of applying my invention to a balance or dummy piston. Fig. 10 being a corresponding brush packing segment; while Fig. 11 shows another method of applying my invention to pistons.

The same reference symbols when desirable, are used to denote corresponding parts on the different drawings which are to a considerable extent of a diagrammatic nature.

In carrying my invention into effect according to one form, the packing is constructed in any convenient manner of a large number of fine wires, *a*, set in a holding ring, *b*, or the like, so that the working face of the packing is of brush like form and is placed so as to contact with or be in close proximity to the surface of the shaft or other part at which it is desired to reduce the leakage to a minimum, thus providing an exceedingly efficient joint in which the necessity for fine adjustment of the bearings is dispensed with.

A general view of a part of a Parsons or pressure flow turbine fitted with brush packing according to my invention is shown in Fig. 1, in which the running and standing blades are denoted by the letters, *c* and *d*, respectively. The brushes, *a'*, are shown somewhat conventionally in their corresponding holding rings, *b'*, which are secured in grooves in the turbine casing by means, for instance, of the calking strips, *e*, the brushes bearing on the shrouding rings, *f*, secured to the running blades. The holders, b^2, of the other brushes, a^2, are shown secured by a stiffening ring or shroud, *h*, riveted to the blades by tangs, *i*, left on them for that purpose, the brushes formed in segments or otherwise as convenient being subsequently sprung into the holders or fixed in any other suitable manner; these brushes bear on the body of the rotor between the running blades. In other cases I may prefer to fix the brush packings to the shrouding ring of the running blades and allow the brush-like face to contact with or abut against the surface of the stationary member. The brushes should be adjusted in the first instance so as to rub lightly against the surfaces; they then after running for a short while wear down and make their own bearing.

I shall now describe more in detail, certain methods which I have found satisfactory of constructing the brushes though I wish it to be understood that I do not intend to limit myself to such specific forms. According to one form, the brush wires may be attached to a flat base strip, *k*, (see Fig. 1) by any suitable means such as those used in the manufacture of ordinary brushes, the strip being bent so as to form a complete ring or a part of a ring as required before being secured to the holding ring, *b*. Thus, I may attach the brush wires in groups of circular, rectangular or other form by forming holes in the base strip, *k*, (see Figs. 2 and 3) and securing the central portions of the lengths of wire forming a given group in its appropriate hole by means of a binding wire, *n*, which threads through the groups in turn after the manner common in brush making. I preferably arrange the groups in rings in such a manner that they break joint with one an-

other. I have shown incidentally in Fig. 2 a method of securing a holding ring, *b*, to the part of the turbine, such as the casing, supporting it, according to which a circumferential groove, *o*, is formed by rolling or otherwise so as to leave a tongue, *r*, which can be burred or bent over and so secure the holding ring in place. Fig. 2 also shows that part, *s*, of the turbine with which the brushes contact provided with a series of grooves or serrations, *t*, running circumferentially so as to increase the baffling action of the packing.

According to another form of construction (see Fig. 4) the brush wires, *a*, may be bent over a central wire, *u*, which is then secured in position by the holding ring, *b*, the side flanges, *v*, of which are adapted to provide lateral support to the packing. The holding ring, *b*, may be formed to accommodate more than one ring of packing if desired, (see Fig. 5) and may be formed of dovetailed section to assist in securing it in place. Again, as shown in Figs. 6 and 7, rectangular or other holes may be punched or otherwise formed in the base strip, *k*, so as to leave intermediate bridges, *w*. The brush wires are then passed up through one of the holes, over a bridge and down through an adjacent hole, the base strip so provided with brushes being then secured in the holding ring, *b*, as above.

As shown in Fig. 8, however, the base strip, *k*, and holding ring, *b*, may be integrally combined into one single member, *x*; in the case shown, which is particularly suitable for a shaft packing, intermediate ribs, *z*, separate the brushes into rings, the brush wires of each ring being looped or bent over appropriate bars or bridges, *w*, shown in dotted lines in the figure, as in the preceding modification.

In any of the forms of packing which I have described the wires incline to one side when forced into contact with the opposite surface by whipping of the shaft on account of the relative motion of the contacting parts but in some cases they may be set at a slight angle to the radius to assist this. The packing may be secured either to the stationary casing or to the shaft as convenient. In some cases instead of forming the packing in separate rings around the shaft, it may be distributed in a spiral after the manner of a screw thread, the number of convolutions being of course determined by the difference in pressure of the working fluid at the ends of the spiral; I may sometimes arrange brush like partitions transversely to assist in preventing leakage along the spiral.

In Fig. 9 I have shown the application of my invention to a balance or dummy piston, 2. According to one form I provide the piston with rings, 3, two of which, by way of example, are shown serrated as and for the purpose already described. The packing proper I preferably construct in the form of segments, one of which is shown in Fig. 10, these segments being secured to the turbine casing, 5, in any suitable manner. As shown, however, in Fig. 11, I may dispense with the the rings 3, and adapt a form of packing such as that, for example, described with reference to Fig. 2 to bear directly on the body of the piston. I have also shown in Fig. 11 other forms of serrations, t', t^2, t^3, which I have found satisfactory the underlying idea as above indicated being to provide annular projections or ridges which cut into the brushes and so increase the baffling effect.

In applying my invention as a substitute for known form of labyrinth packing for turbine shafts, I may either form a special base strip and holding ring combined as already described with reference to Fig. 8 or I may merely increase the number of rings of brush packing in which case I may either increase the axial length of the holding ring or use a number of holding rings arranged side by side as in Fig. 11 according to the pressure difference to be provided for.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is: —

1. The combination of a machine member; a second member movable relatively thereto; a plurality of filamentous elements on one of said members and in juxtaposition to the other of said members so as to act as a labyrinth fluid packing.

2. The combination of a machine member, a second member movable relatively thereto; a plurality of filamentous elements associated together so as to form a brush-like structure, and means for retaining said brush-like structure on one of said members and in juxtaposition to the other of said members so as to act as a fluid packing.

3. The combination of a machine member, a second member movable relatively thereto; a plurality of filamentous elements forming a labyrinth fluid packing; means for retaining said filamentous elements on one of said members, together with a plurality of grooves in the other of said members in juxtaposition to said filamentous elements and co-acting therewith to increase the baffling effect.

4. The combination of a machine member, a second member movable relatively thereto; a plurality of filamentous elements associated together so as to form a brush like structure, means for retaining said brush like structure on one of said members together with a plurality of grooves on the other of said members in juxtaposition to said filamentous elements and co-acting therewith to increase the baffling effect.

5. The combination of a machine member; a second member movable relatively thereto; a plurality of filamentous elements bundled

together, means for retaining said bundled filamentous elements on one of said members and in juxtaposition to the other of said members so as to form a labyrinth fluid packing.

6. The combination of a machine member; a second member movable relatively thereto; a dense brush-like structure carried by one of said members and in juxtaposition to the other of said members so as to act as a fluid packing.

7. The combination of plurality of relatively movable turbine members; a dense brush-like structure carried by one of said members and in juxtaposition to another of said members so as to act as a fluid packing.

8. The combination of a turbine element and a turbine blade, said turbine parts being relatively movable; together with a dense brush-like structure disposed between said turbine parts to act as a fluid packing.

9. The combination of two machine members relatively movable with an intervening clearance through which fluid tends to flow in a certain direction; a multiplicity of long slender elements forming a brush-like structure carried by and projecting lengthwise from one of said members and in juxtaposition to the other to act as a fluid packing, said long slender elements being densely massed in said certain direction in which said fluid tends to flow.

10. The combination of two relatively movable machine members, with a fluid packing disposed therebetween, said fluid packing consisting of a densely massed aggregation of long slender elements carried by and projecting lengthwise from one of said members and in juxtaposition to the other of said members so as to brush or sweep said other member under certain conditions.

11. The combination of a turbine element; a series of turbine blades, said element and said blades being relatively movable with an intervening clearance through which fluid tends to flow in a certain direction, together with a fluid packing disposed between said turbine element and said blades, said fluid packing consisting in a brush-like structure formed of a multiplicity of long slender elements densely massed in said certain direction in which said fluid tends to flow.

12. The combination of a turbine element; a series of turbine blades carrying a steadying strip, said element and said strip being relatively movable with an intervening clearance through which fluid tends to flow in a certain direction; together with a fluid packing disposed between said turbine element and said strip, said fluid packing consisting in a brush-like structure formed of a multiplicity of long slender elements densely massed in said certain direction in which said fluid tends to flow.

13. The combination of a turbine element and a series of turbine blades, said element and said blades being relatively movable together with a fluid packing having a dense brush-like structure disposed between said element and said blades.

14. The combination of a turbine element and a series of turbine blades carrying a steadying strip, said turbine element and said strip being relatively movable together with a fluid packing having a dense brush-like structure disposed between said element and said strip.

15. The combination of a machine member; a fluid packing having a dense brush-like structure carried by said member; a second machine member provided with a plurality of grooves, said first mentioned and said second mentioned machine members being relatively movable, and said grooves being disposed in juxtaposition to said packing and co-acting therewith to increase the baffling effect.

16. The combination of two machine members with a fluid packing disposed therebetween, said packing having a dense brush-like structure.

17. As an article of manufacture a labyrinth fluid packing of bundled filamentous elements.

18. As an article of manufacture, a fluid packing having a multiplicity of like flexible elastic members labyrinthally disposed in relation to one another.

19. As an article of manufacture, a fluid packing having a multiplicity of flexible elastic members massed together to form a brush-like structure.

20. As an article of manufacture, a fluid packing having a multiplicity of wires massed together to form a brush-like structure.

21. As an article of manufacture, a fluid packing having a multiplicity of flexible elastic members disposed labyrinthally with regard to one another to form a brush-like structure.

22. As an article of manufacture, a labyrinth fluid packing having a multiplicity of filamentous elements massed together to form a brush-like structure.

23. As an article of manufacture, a labyrinth fluid packing having a multiplicity of long slender elements massed together to form a brush-like structure.

24. As an article of manufacture, a fluid packing having flexible elastic members each long in comparison with its width and breadth, said members being closely assembled in large numbers both width-wise and breadth-wise to form a packing having a cross section large in proportion to the cross section of the individual members.

25. As an article of manufacture, a fluid packing having a multiplicity of long slender

members closely assembled in each of two perpendicular directions at right angles to their length.

26. As an article of manufacture, a fluid packing having a dense brush-like structure.

27. As an article of manufacture; a labyrinth fluid packing consisting of a densely crowded mass of flexible elastic elements.

28. As an article of manufacture, a labyrinth fluid packing consisting of a densely crowded mass of long slender elements.

29. As an article of manufacture, a fluid packing having in combination a base and a densely massed aggregation of long slender elements carried by and projecting lengthwise from said base.

30. As an article of manufacture, a labyrinth fluid packing having in combination a base and numerous flexible elastic members projecting from said base to form a structure discontinuous in two dimensions.

31. As an article of manufacture, a labyrinth fluid packing having in combination a base and an aggregation of flexible elastic members projecting therefrom and densely massed in two dimensions to form a structure discontinuous in said same dimensions.

32. As an article of manufacture, a labyrinth fluid packing having in combination a base and an aggregation of flexible elastic members projecting therefrom, said members being uniformly distributed in two dimensions.

33. As an article of manufacture, a labyrinth fluid packing having numerous operative portions uniformly distributed in two dimensions over an area.

34. As an article of manufacture, a labyrinth fluid packing having numerous like operative portions uniformly distributed in two dimensions over an area.

35. As an article of manufacture, a labyrinth fluid packing having numerous filamentous members uniformly distributed in two dimensions over an area.

36. As an article of manufacture, a labyrinth fluid packing having numerous wires uniformly distributed in two dimensions over an area.

37. As an article of manufacture, a labyrinth fluid packing having numerous long slender elements uniformly distributed in two dimensions over an area.

In testimony whereof, I affix my signature in the presence of two witnesses.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:

GEORGE CROSLAND TAYLOR,

JAMES CARLTON STITT.