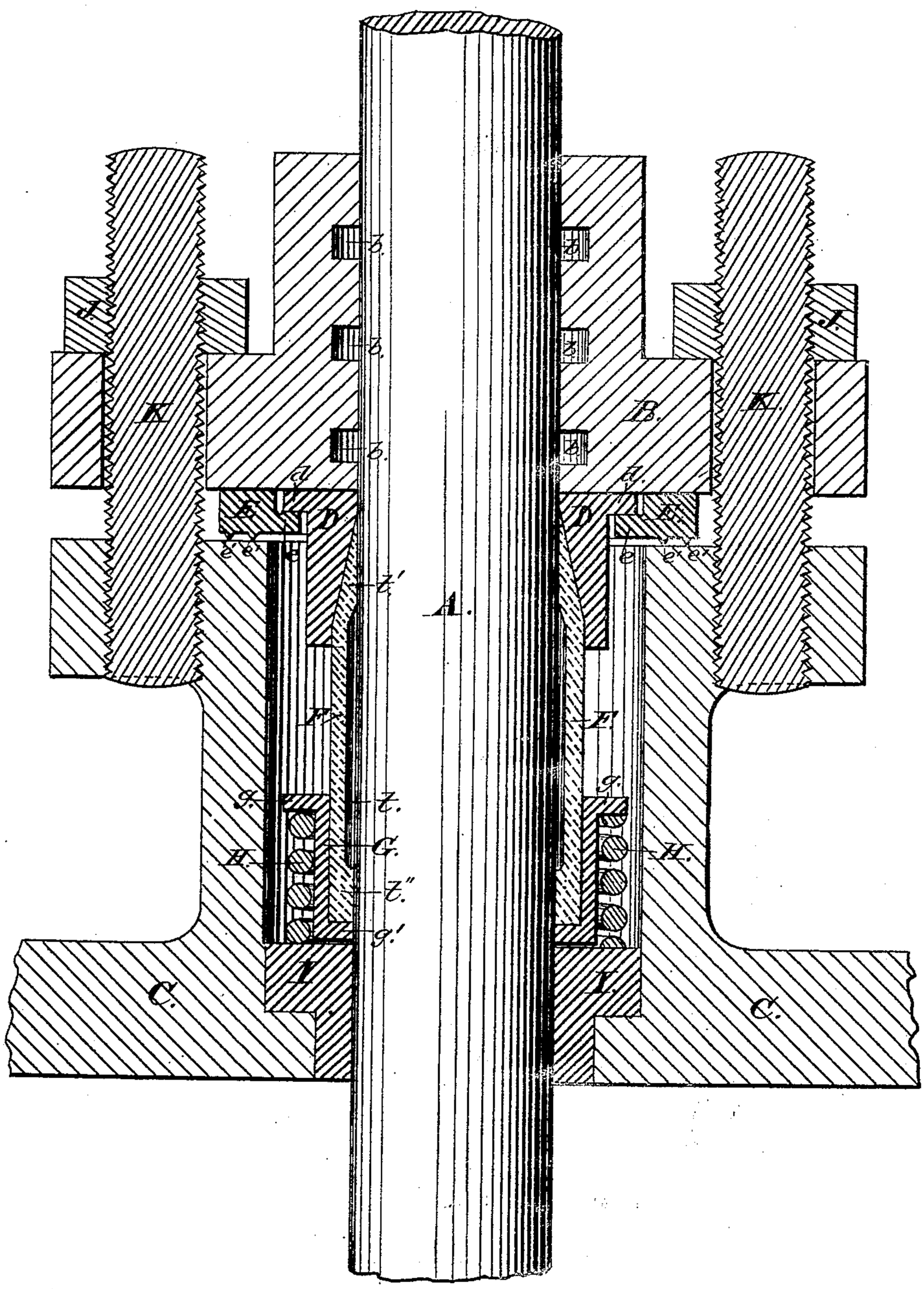
2 Sheets—Sheet 1.

G. M. DAVIS.

Piston-Rod and Valve-Stem Packing.

No. 210,504. **Patented Dec. 3, 1878.**

Fig. 1.



Witnesses:

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G. M. DAVIS.

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Fig. 2.

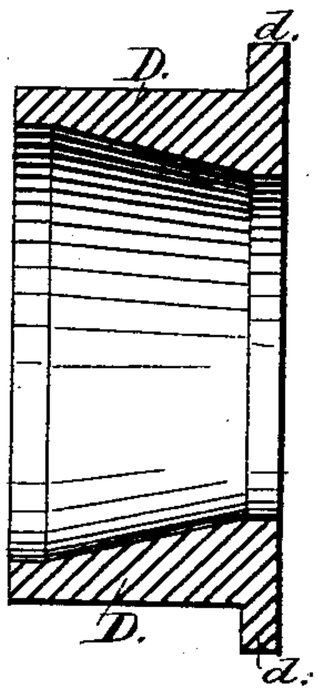


Fig. 3.

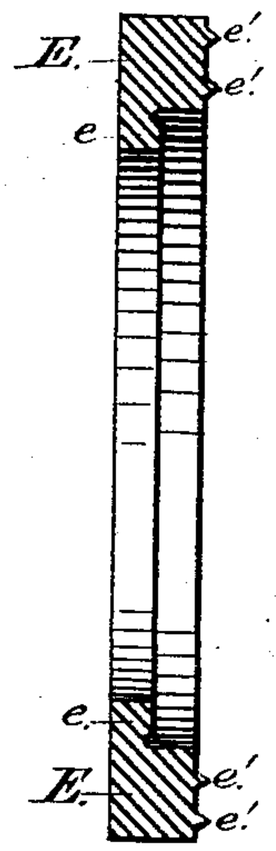


Fig. 4.

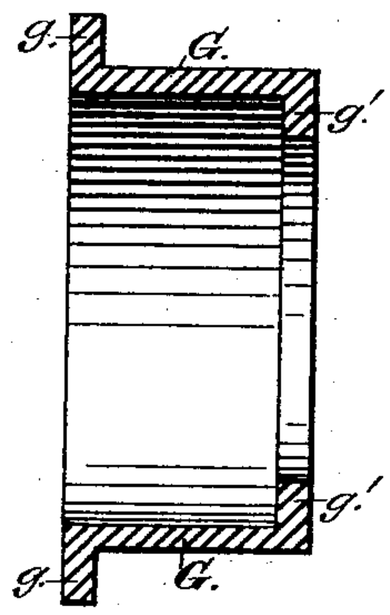


Fig. 5.

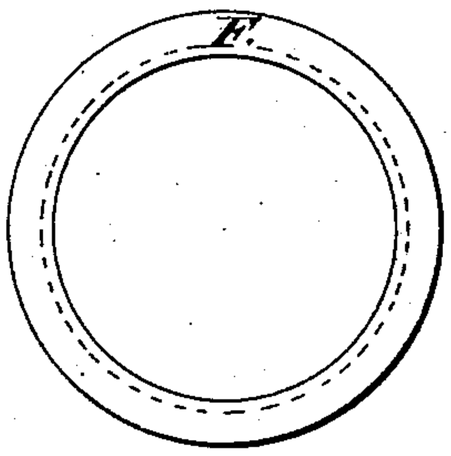
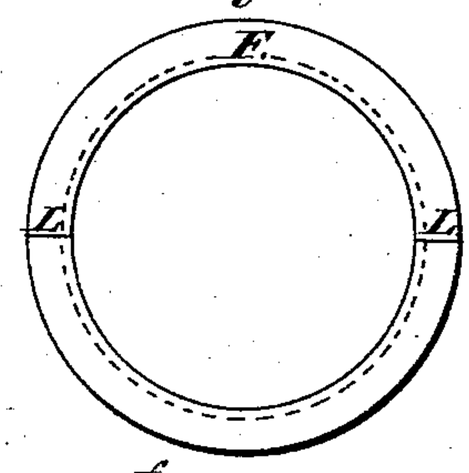


Fig. 6.



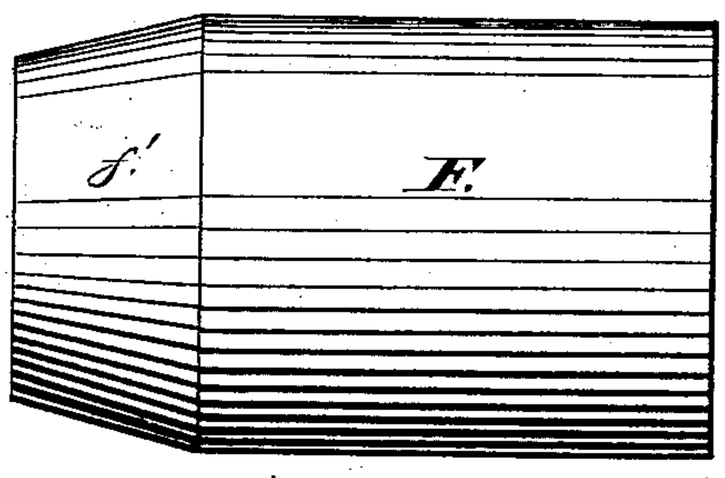


Fig. 7.

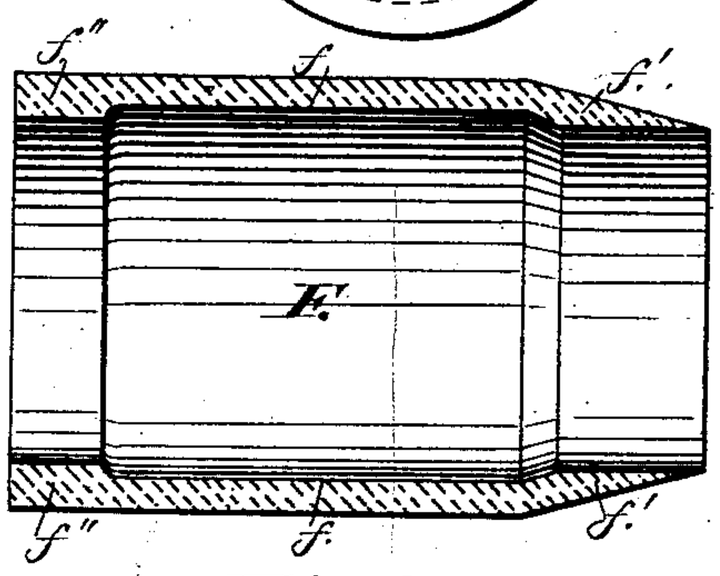


Fig. 8.

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UNITED STATES PATENT OFFICE.

GEORGE M. DAVIS, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN PISTON-ROD AND VALVE-STEM PACKINGS.

Specification forming part of Letters Patent No. **210,504**, dated December 3, 1878; application filed November 5, 1878.

To all whom it may concern:

Be it known that I, GEORGE M. DAVIS, of the city of Chicago, county of Cook, State of Illinois, have invented a new and useful Improvement in Piston-Rod and Valve-Stem Packings, which improvement is fully set forth in the following specification and accompanying drawings, in which—

Figure 1, Sheet 1, represents the apparatus when secured to the stuffing-box of an engine; and Figs. 2, 3, 4, 5, 6, 7, and 8, Sheet 2, sectional views of the different portions of the apparatus.

The object of my device is to furnish a perfect packing for piston-rods and valve-stems of steam-engines.

In this construction the packing proper consists of a soft anti-friction metal, which has but little expansion under the influence of heat, and is in the form of a solid ring or shell, without transverse openings of any description, to enable it to close together around the rod, but is drawn down in solid form at its outer end by the action of an expanding and contracting ring, which surrounds it at that place.

This packing ring or shell F may be cast solid, as shown in Figs. 5 and 7, or made in halves or parts, as shown in Figs. 6 and 8, each part fitting squarely against the other, as shown in Fig. 6, L forming an entire ring or shell, without any opening or joint which could allow it to draw together or close around the rod, and held firmly to each other by the ring or follower G surrounding them at one end, and by the expanding and contracting ring D at the other, making its action within the expanding and contracting ring, and in all other points of action, exactly the same as if it were cast perfectly solid, the only reason for making it in parts being for the purpose of more easily applying it to engines, as it saves the trouble of disconnecting the rods.

Upon the inside the packing ring or shell is hollowed out, so as to form a cavity around the rod, as shown at *f f*, for the purpose of receiving and containing water and oil, with which it fills from the condensation of the steam and the lubrication of the valves, and which forms a water-packing, and helps to more perfectly keep the steam from escaping, as the steam would have to force it from its confinement in the cavity and out between the rod and the metal closed upon it at the outer end of the packing ring or shell ere it could escape, which action is also overcome by the steam itself becoming constantly condensed on the rods and in the stuffing-boxes of the engine, thus keeping the cavity (as also the entire stuffing-box) filled with water and oil, which are carried or forced into the cavity by the rod passing through the packing ring or shell and the pressure of the steam itself, and are held there by the outer end of the packing ring or shell being so closely in contact with the rod, as it is caused to be by the action of the expanding and contracting ring D and the spring H combined.

At its outer end, *f'*, the packing ring or shell is cast with a proper taper upon the outside to fit the incline of the expanding and contracting ring D, and is kept to that taper or shape by the action of the said ring upon it as it is drawn down onto the rod and worn away upon the inside. Upon its inner end, *f''*, it is made of a size upon the inside to fit loosely around the rod. Upon the outside it is perfectly straight from its inner end to the point at which it commences to taper, to fit the incline of the expanding and contracting ring.

The expanding and contracting ring D is for the purpose of drawing the packing ring or shell down upon the rod, and is made of any metal whose expansive and contractive qualities are greater than those of the soft metal of which the packing ring or shell is composed and the iron or steel of which the piston-rod or valve-stem is made. It is made to fit the rod at its outer end, and is formed with an inclined chamber upon the inside, for the purpose of allowing the packing ring or shell to be moved slightly forward by the pressure of the spring, when it (the expanding and contracting ring, heated by the steam) expands, thus keeping the inclined side or end of the packing ring or shell in contact with the incline of the chamber, and causing it (the packing ring or shell) to be compressed or drawn down upon the rod, when the heat of the steam is withdrawn, and the expanding and contracting ring contracts. Upon its outer side it is provided with a flange

or rim, *d*, which fits loosely into a ring, E, which holds it in close contact with the gland or plate B, upon which it slides, when caused to do so by the motion of the rod, laterally, in case of wear in the gland or plate, thus keeping the packing ring or shell in perfect adjustment with the rod, and overcoming any lateral wear or friction which might otherwise take place.

The ring E is interposed between the gland or plate B and the stuffing-box C, and serves to keep the expanding and contracting ring D securely in its place against the gland or plate. It is constructed with a flange, *e*, projecting inwardly, upon which the flange of the expanding and contracting ring D rests, and is also provided upon the inner side with the sharp projections *e'*, which serve to make a steam-tight joint between it and the stuffing-box C, when it is pressed tightly against it by the gland or plate being fastened against it.

The follower G is for the purpose of holding the packing ring or shell firmly together at the inner end, (when the packing ring or shell is made in halves or parts,) and to receive the action of the spring H against a flange or rim, *g*, projecting outward at its outer end. For that purpose it is made to fit closely around the packing ring or shell, and at its inner end is provided with the flange *g'*, against which the inner end of the packing ring or shell impacts.

The spring H is for the purpose of moving and holding the packing ring or shell forward, thus keeping the incline of the packing ring or shell in contact with the inclined chamber of the expanding and contracting ring.

The gland or plate B is the ordinary gland used in packing with hemp, with the exception of the grooves *b b b* upon the inside, which are for the purpose of retaining the oil, with which the rod is lubricated. It is used in the reverse manner to that when used for packing with hemp, and, when secured against the ring E by means of the nuts J and studs K, (which, as well as the stuffing-box C, are portions of the engine itself,) keeps the entire construction in place.

Although this construction of packing is more simple, cheaper, and can be applied easier than any of the metallic packings heretofore invented, it still possesses far greater points of advantage when fully understood and considered.

Engines, especially locomotives, whether large or small, all use steam at about the same temperature, and as it is the heat, and not the pressure, (as is the case in other metallic packings,) of the steam which is used to operate this packing, it will be readily seen that it will work equally well on all classes of engines, which is not the case with any other packing heretofore brought into use, (especially for valve-stems.)

To give a more complete knowledge of the merits of this construction of packing, I deem an explanation of its action necessary.

Upon the steam being admitted to the cylinder or steam-chest, and coming in contact with the expanding and contracting ring, the ring is caused to expand as it gradually becomes heated, which, as the metal of which it is composed has greater qualities of expansion than the metal of which the packing ring or shell (and also that of the piston-rod and valve-stem) is formed, it will be seen that it would therefore become separated from the packing ring or shell were it not for the spring moving the ring or shell forward, and keeping its inclined outside against the incline of the chamber of the expanding and contracting ring. Therefore, when an engine is in motion and using steam, it will be readily observed that no action to cause the metal of the packing ring or shell to be drawn down upon the rod takes place, and that it is simply held in its position by the pressure of the spring, both as regards the rod and the expanding and contracting ring, and that until the heat (caused by the steam) is removed no contraction of any of the parts will take place; and it is at this time that the water or condensed steam forms the packing, as heretofore described in the specification. From this it will be seen that the only wear of both the rod and the packing ring or shell takes place during the time in which the expanding and contracting ring is expanding after starting the engine, and until the engine ceases to move after the steam is shut off, when the expanding and contracting ring contracts upon the packing ring or shell and draws it once more closely to the rod. By this means the wearing of a valve-stem hollow is entirely overcome, as the packing only wears the rod when the steam is shut off, or upon starting the engine, at which times, the valve being at its full stroke, it wears the rod the full length of its stroke, and keeps it for that distance perfectly straight and true, which is the opposite effect to that of any other packing, as they bind the rod as hard after the engine is in motion and the valve at short stroke as when starting and stopping, thereby causing very unequal wear, and making it in a short time necessary to turn the rods up true in order to pack them at all. With this packing the rods will at all times run perfectly cool, not only from the decrease of friction, but by being at all times perfectly lubricated by passing through the water and oil which collect in the cavity of the packing ring or shell.

Having thus described my invention, what I claim as new, and wish to secure by Letters Patent, is as follows:

1. A piston or other rod packing in which the wear is taken up by the contraction of a metallic ring surrounding the packing, in the manner substantially as specified.

2. In a stuffing-box, an annular metallic packing, in combination with a contracting ring surrounding its reduced end, whereby the wear of the packing is taken up, substantially as specified.

3. In a stuffing-box, an annular metallic packing-ring, in combination with an expanding and contracting ring, whereby the rod is relieved of pressure from the packing-ring in the presence of steam, and the wear of the ring taken up in its absence, as shown and described.

4. In a stuffing-box, an annular metallic packing-ring provided with a conical end, and a rabbet between its shouldered ends, whereby a water-space is formed between the rod and the packing, as shown and described.

5. In a stuffing-box, an annular metallic packing-ring made in two or more parts, in combination with a follower at one end, by which the parts are held in place, and the contracting ring at its opposite end, which takes up the wear, substantially as described.

6. In a stuffing-box, an annular metallic packing provided at one end with a follower and spring, in combination with a contracting ring which surrounds its effective packing-surface, substantially as specified.

7. As an article of manufacture, an annular metallic packing, F, (made of one or more pieces,) provided with a conical end and a rabbet between its shouldered ends, substantially as described.

8. In combination with a stuffing-box and gland, the rabbeted supporting-ring E and the ring D, for the purpose specified.

GEORGE M. DAVIS.

Witnesses:
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SAMUEL HARRIS.