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J. P. RANDERSON.

PACKING.

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Fig. 1

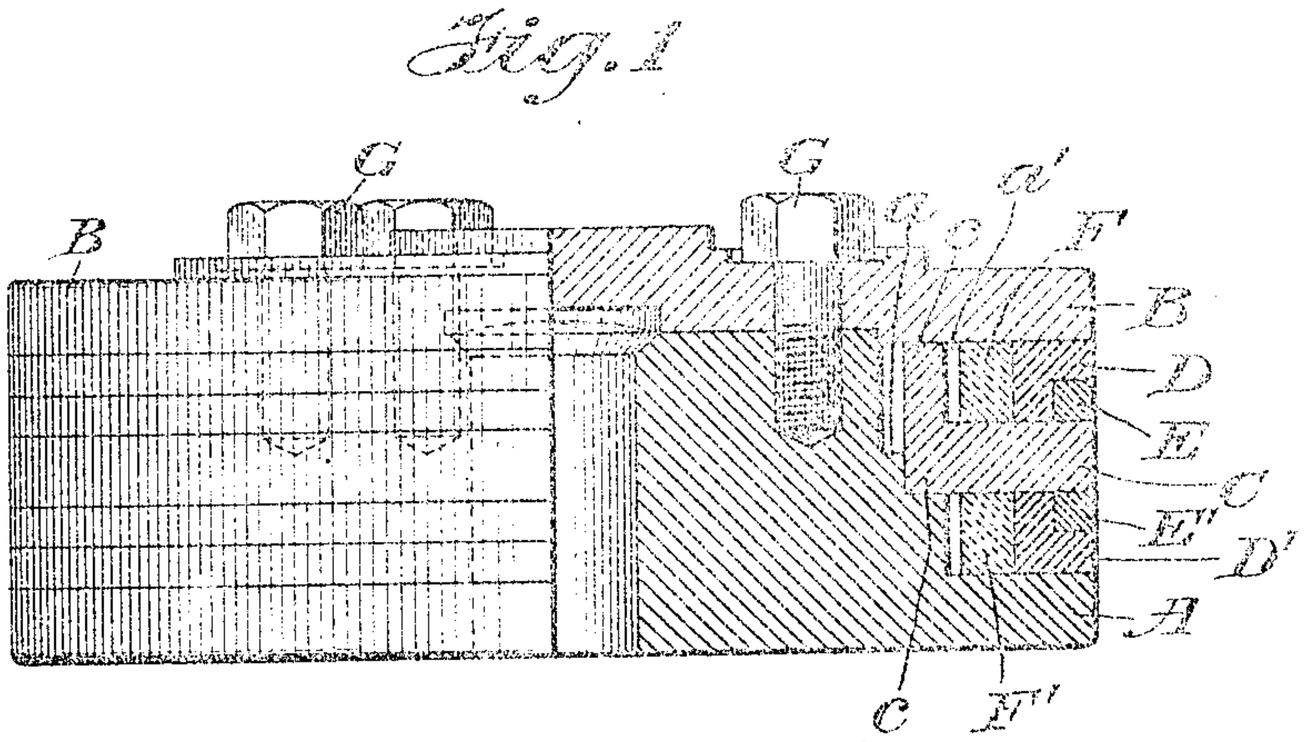
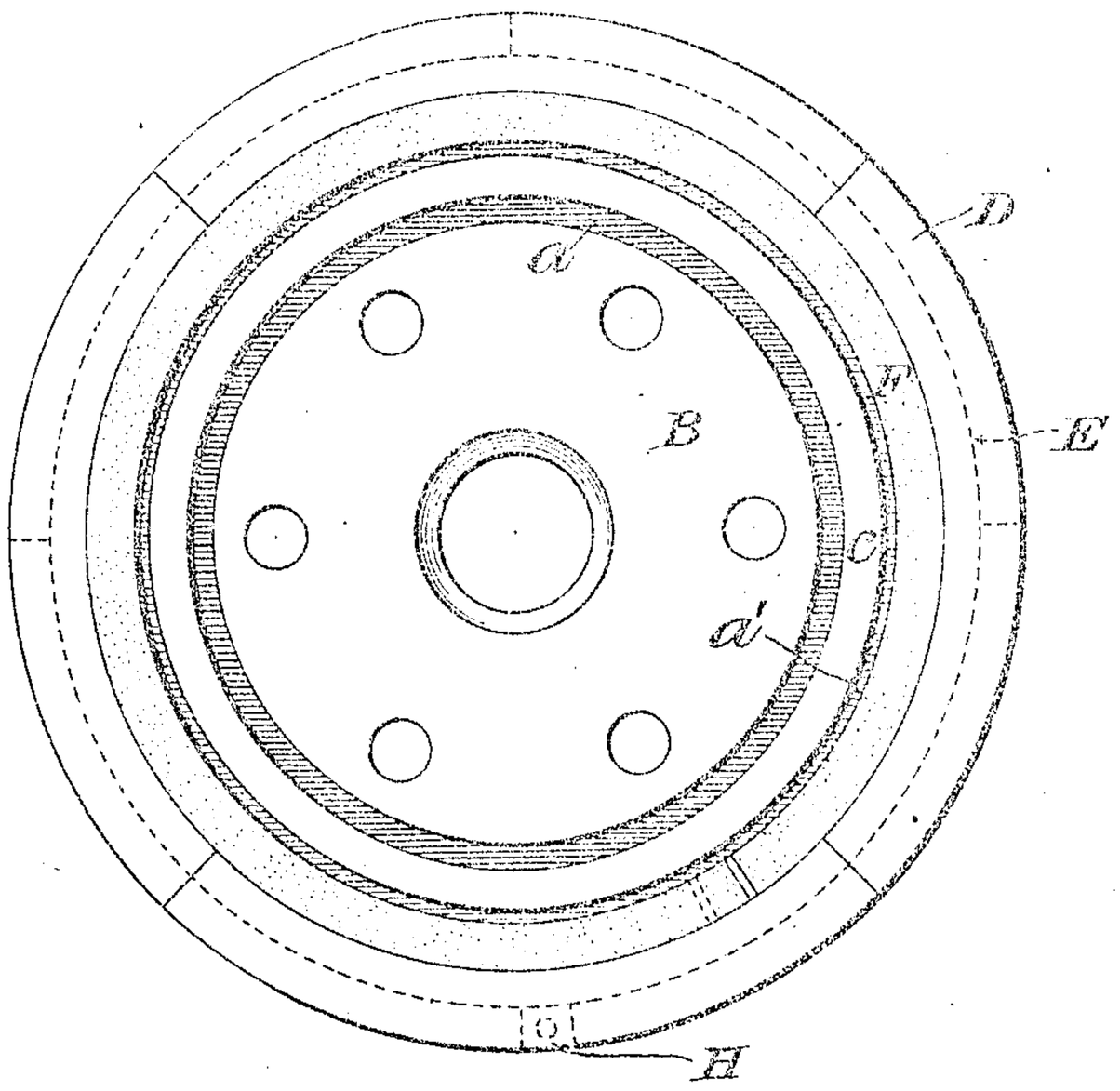


Fig. 2



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UNITED STATES PATENT OFFICE.

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PACKING.

No. 892,620. Specification of Letters Patent. Patented July 7, 1908.

Application filed December 19, 1907. Serial No. 407,217.

To all whom it may concern:

Be it known that I, JOHN P. RANDERSON, a citizen of the United States, residing in the city of Albany, in the State of New York, have invented certain new and useful Improvements in Packings, of which the following is a specification.

My present invention relates to packings, especially for pistons of fluid-pressure engines such as steam, water, gas or air motors, although in some forms it may be applied to stuffing-boxes.

One of the best known of the ordinary piston packings is the so-called "Dunbar", consisting of intermeshing packing-rings cut into sections which break joints so that steam cannot blow through; these are held in place by the live steam, which has unrestricted access to their rear faces and presses them out against the inside surface of the cylinder. This form is quite old, and though extensively used is subject to several defects; the excessive pressure of the steam causes it to waste considerable power in friction, while in addition sectional leaf springs are used in rear of the packing-rings, which make them hard to get into place and tend to tilt the sections, thus opening the joints so that there is a leakage of steam. The most serious defect in this packing, however, is one that is common to all of those devices in which unrestricted steam pressure is used to keep the rings in close contact with the cylinder, that is, that such packings tend to wear the cylinder more in the middle than at the ends. This is because, after the piston has passed the middle of the cylinder, the cut-off acts and the pressure gradually diminishes until the exhaust opens. The effect of this is that only a certain part of the middle of the cylinder is traversed in both directions by the piston with steam at or about full pressure, so that the cylinder gradually becomes barrel-shaped and the consequent radial movement of the packing-rings under the varying steam-pressure at different parts of the stroke causes them to wear loose so that the piston soon leaks, making repair bills large. Another defect of the old piston-packings has been that where the engine was double-acting, as is usually the case with steam-engines, the bull-ring or dividing-ring between the two sets of packing-rings is apt to corrode in place, and this renders it very difficult to get it out to make necessary repairs, since the entire under surface adheres to the body of the piston, which often must be taken out and heated to extract the ring. Commonly a T-ring or ring of T-shaped cross-section is employed as a bull-ring. This is a further disadvantage, in that it is necessary to put in the bull-ring before the rest of the packing can be assembled, and this makes it very difficult indeed to assemble the split rings upon the inner side (the side away from the mechanic) of the bull-ring. While not so difficult where a vertical cylinder is employed because there the piston can be raised, even then, where springs are used behind the split rings, it becomes troublesome; the least inaccuracy of procedure is apt to lodge some part of the packing-rings in the ports, whence it is difficult to extract it. Sometimes it becomes necessary to take the cylinder off the frame to do so.

The first difficulty named above I obviate by fitting to the piston sectional packing-rings breaking joints, and making a close working fit in grooves in the piston; and placing behind the packing-rings an expanding ring, also making a working fit with the groove in which the packing-rings are located. The result of this construction is that the steam or other fluid pressure leaks in behind the packing-rings quite slowly and although it is not entirely excluded it is not, as in old forms of packing known to me, permitted to enter freely the spaces between the packing-rings and the piston; and the spaces by which it does enter being only the extremely restricted channels between the surfaces making a working fit and provided with lubrication are insufficient to enable the pressure in the confined space between the packing-ring and the piston to vary freely as the pressure in the cylinder varies during the travel of the piston. A certain average pressure, therefore, is for all practical purposes steadily maintained against the packing-rings while the engine is running, this average being obviously somewhat below the full boiler pressure, but above the pressure to which the steam expands after the cut-off acts. The effect of this arrangement is to maintain a substantially uniform and constant friction

between the walls of the cylinder and the packing-rings at all parts of the stroke, so far as the fluid pressure is concerned. In conjunction with this the expanding ring to which I refer is so arranged, as presently to be pointed out, that its centrifugal effort does not substantially change with time. The effect of the combination of these two factors is such that the piston operates under substantially constant conditions of friction and pressure between the walls of the cylinder and the packing-rings, which so far as I know is a result not heretofore attained.

The second difficulty is obviated by using a bull-ring of "L" shaped cross-section and having it rest upon a circumferential shoulder in the body of the piston. By this construction the first set of packing-rings, with the expanding-rings behind them, may be put in place before the bull-ring is inserted; after this latter ring is in place the second set of packing-rings necessary in a double-acting piston may be put in place and a face-plate secured upon the piston. The shoulder on the piston is turned to a close fit with the inner periphery of the bull-ring, so that when it is necessary to take down the apparatus a simple tap of the hammer will so loosen the bull-ring that it may readily be lifted out. The shoulder may be turned upon the inner periphery of the bull-ring if desired, but generally the piston is better and easier to manage.

Expanding rings have been used in the rear of the sectional packing-rings in order to keep the latter in place, but heretofore these have generally been formed of steel and have been tempered in order to make them hold up to their work. The difficulty with this, however, is that the constant passage of the hot steam or gas through the cylinder draws the temper of the expanding ring so that it loses its elasticity and fails to serve its purpose.

The defect named is peculiarly evident in explosion engines, and particularly in those in which the compression is carried to a high point, so that the explosion generates great heat. In fact, the pistons of modern gas-engines are often run almost red hot or at least at very high temperatures, and as no practical provision can be made for cooling them as is done with the cylinder, there is very great friction with the cylinder walls, which do not expand proportionately. In addition the variations of pressure in a gas-engine cylinder are very much greater than in the steam cylinder, and the drop is proportionately greater in the latter part of the stroke. The consequence of this is that gas-engine cylinders often wear into peculiar shapes and are very difficult to keep in order, sometimes leaking so badly as to lose a considerable part of the power generated by the explosion. In place of the steel, therefore, I use a substantial ring of cast-iron, the expansion of which may be adjusted readily and which when once adjusted will not change in this respect at the temperatures in which it is ordinarily employed. Further, if it should become necessary to cause the ring to expand a little more, so as to engage the packing-rings more firmly with the surface of the cylinder and thus compensate for wear, the rings may be slightly sprung with a ball-peen hammer, enough to take up any wear which can occur in the packing which I have devised.

Packing-rings have heretofore been held in relative circumferential position by pins secured in one of them and fitting into sockets in the other. With this construction it is necessary to provide a little lost motion between the pin and socket, otherwise the sections may tilt upon the pins, opening the joints and allowing steam to leak past the packing; if the pin be made tight enough to prevent this the joint binds and the ring sometimes fails to expand properly so that contact between it and the cylinder is not sufficiently tight. To obviate this difficulty I provide an abutment upon one of the packing rings, substantially of the same cross-section as the other ring or rings which it protects against relative circumferential motion. In practice I have found this to be a complete remedy. An additional advantage is that the abutment may be of a size to compensate for the space lost by the saw-kerfs which divide the packing rings, keeping the latter tighter than is possible with the pins.

The accompanying drawings show an embodiment of my invention as applied to a double-acting piston used in a steam-engine. Obviously to apply the same construction to a stuffing-box or gland it would be necessary to reverse the direction of concavity.

Figure 1 represents a central cross-section, partly in side elevation, of a piston provided with my improved packing; and Fig. 2 is an end elevation of such a piston.

In the drawings, A is the piston, and B is the face-plate, which is held in place by the bolts G, G.

C is the bull-ring, of L-shaped cross section as shown; the portion *c* being arranged to engage firmly with the piston A and face-plate B when the bolts are drawn tight. In the drawings the ring is shown as flush with the diameter of the piston, but it may be made, as is usual, slightly relieved so that it will not touch the cylinder. A shoulder *a* is turned upon the piston, against which the bottom of the bull-ring rests with a close fit, so that it adjusts itself in position by simply pressing it into place.

D, D^1 are packing-rings of gnomon-shaped

cross-section, one of the longer sides of which is turned towards the steam pressure, that is, in case of the ring D toward the face-plate B, and in case of the ring D^1 toward the piston A, from which directions respectively the pressure of steam comes in the double-acting engine. Complementing the ring D D^1 to form rectangles in cross-section are the rings E E^1; the two sets of rings break joints, as is customary in devices of this character; and to preserve their relative circumferential position the abutment H (see Fig. 2), is employed. This abutment is of the same size as the cross-section of the ring E, so that it completes the circle formed by that ring, and is of sufficient arc to compensate for the shortening of the rings E E^1 by the saw-kerfs. In the rear of the rings D D^1 are springs F F^1. These are prepared from complete cast-iron rings of substantial thickness; in the engine from which the drawings are prepared, which is of 10″ bore, these rings are about ½″ thick and are, with the rings D, E, etc., arranged with a working fit in the space between the bull-ring C and the piston A on the one side, and the face-plate B on the other. They are carefully machined, and a small portion sufficient to render them easily manageable is then cut out of them. By adjusting with the hammer, as already pointed out, they may be given precisely the amount of expansion desired to keep the packing-rings always closely against the sides of the cylinder. A small clearance space a^1 is left in the rear of each of these rings; the expansion of the rings F F^1 is relied upon to keep the packing rings up to their work when the engine is idle. These rings making a working fit, as already pointed out, with the other parts of the piston, will with the lubrication ordinarily employed altogether prevent too rapid changes in the pressure of steam in the spaces in the rear of the rings F F^1.

The piston is more conveniently assembled than any with which I am acquainted; it is best to proceed as follows: First, the rings D^1 are placed in position after the piston is inserted in the cylinder, the long side of the ring D^1 being placed against the piston; then the sections of the rings E^1 are placed in positions which will break joints with the sections of the ring D^1. The ring F^1 is then sprung into place, this being easily effected by compressing it. The bull-ring C is then placed in position, and the operation proceeds by placing first the sections of the ring E in place and then the sections of the ring D, breaking joints with those of the ring E, after which ring F is sprung into place and the face-plate B is applied, the bolts G being screwed down so as to engage the face-plate firmly with the bull-ring and hold the latter in position.

In practice I have found the above described packing to be exceedingly satisfactory, it having been in use for more than a year and remaining entirely tight under commercial conditions, and this without undue friction.

Having thus described my invention, what I claim and wish to protect by Letters-Patent of the United States is:

1. In a piston packing, the combination, with a cylinder, and a piston having sectional packing-rings breaking joints and making a working fit in a circumferential groove in the piston, of a cast-iron expanding ring also making a working fit in such groove and interposed between the piston and the packing-rings.

2. In a packing, the combination, with sectional packing-rings breaking joints and means for preserving their relative circumferential position, of a cast-iron expanding ring of substantial thickness pressing the packing-rings against the surface with which they have relative motion.

3. In a packing, the combination of a sectional packing-ring of gnomon cross-section, a second packing ring of cross-section completing the parallelogram and breaking joints with the first ring, a long side of the gnomon being turned towards the pressure, and an expanding ring of substantial thickness made of cast-iron, pressing the rings against the surface to be packed; one of the rings being prevented from circumferential movement relative to the other by an abutment of cross-section like that of the ring and completing its circumference, the abutment being attached to the other ring.

4. In a packing, the combination, with a bull-ring of "L" cross-section, of sectional packing-rings upon each side thereof, breaking joints with one another; one of the rings of each set being substantially of gnomon cross-section, and the other of a section to complete the parallelogram.

5. In a piston-packing, the combination, with a piston having a circumferential shoulder, of a bull-ring resting upon the shoulder, packing-rings upon each side of the bull-ring, and a face-plate.

6. In a piston-packing, the combination, with a piston, of a bull-ring engaging therewith by less than the width of its inner periphery, packing-rings on each side of the bull-ring, and a face-plate.

7. In a piston-packing, the combination, with the piston, of a bull-ring of "L" cross-section, engaging by its inner periphery with the piston along a shoulder of less than the width of such periphery; packing-rings upon each side of the bull-ring, and a face-plate.

8. In a piston-packing, the combination, with the piston, of an "L" shaped bull-ring, packing-rings upon each side thereof, one ring of each set being of gnomon cross-section

and the other of section completing the parallelogram, the rings being divided into sections breaking joints; a cast-iron expanding ring under each set of packing-rings, and a face-plate; all of the rings making a working fit in a circumferential groove in the piston, as set forth.

In witness whereof I have hereunto set my name in the presence of two witnesses.

JOHN P. RANDERSON.

Witnesses:
WILLIAM EASTON,
BORDEN H. MILLS.