

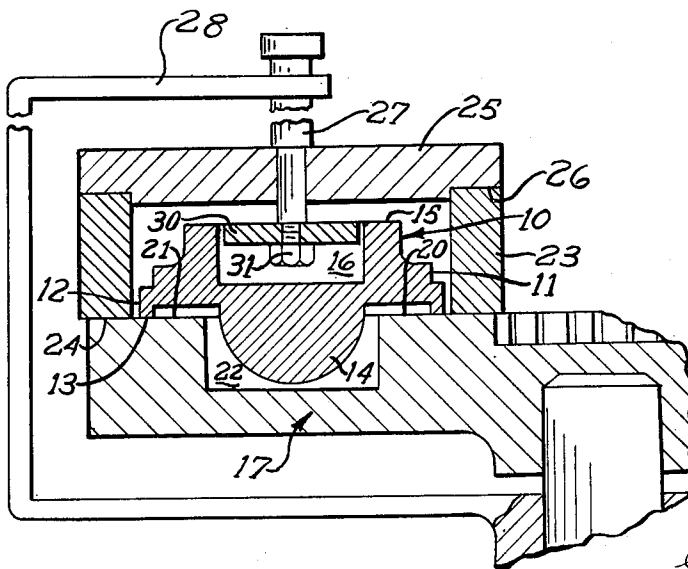
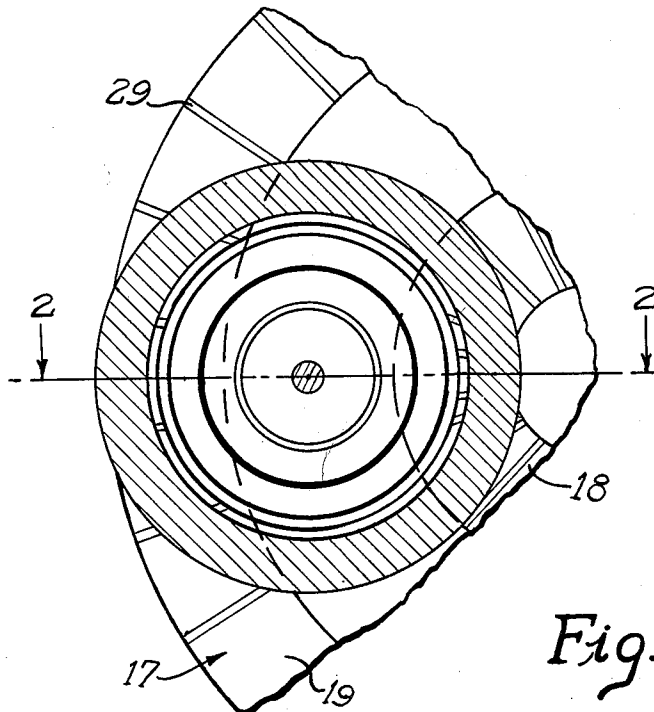
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APPARATUS FOR LAPPING SHOULDERS

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APPARATUS FOR LAPPING SHOULDERS

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This invention relates to an apparatus for grinding or lapping surfaces and particularly to an apparatus for lapping a surface on an object which is axially spaced from either end thereof so that the surface defines a shoulder on the object. Such articles may be valve plates, rotary seal seats, etc. for hydraulic equipment or the like. For purposes of illustration, this invention will be described with reference to its application to valve plates.

It is desirable in many instances to design a valve disc in such a way that smooth flow of the fluid controlled by the valve may be effected past the valve while said valve is partially open. This is accomplished by providing a rounded extension on the valve disc which projects into the stream to help guide the flow of the liquid. The seat for the disc, however, is located between the ends of the valve disc so that the sealing surface on the valve disc adapted to contact the seat is axially spaced from the extension. To prevent leakage of fluid past the seat, the seat and disc mating surfaces must be lapped to a perfectly flat contour. Such lapping, however, is difficult to achieve inasmuch as no conventional flat lap can be used on the entire mating face on the valve disc due to the presence of the extension.

It has been customary in the past to perform the lapping operation on valve discs by using a flat lap having an opening therein to receive the protruding end of the disc, the valve disc being rotated on the lap about the axis of the opening. This, however, does not permit the continuous presentation of a different lap surface to the disc during the lapping operation and hence the lap is rapidly grooved and must be refinished at short intervals.

The principal object of this invention is to provide a lap for lapping valve discs and other articles of the type described having a part extending, said lap being adapted to present different surfaces to the disc continuously as the lapping operation proceeds, whereby to eliminate grooving of the lap and the consequent non-uniform lapping of the disc.

Another object of this invention is to provide a lap for lapping valve discs or the like of the type above described, wherein those areas of the lap not operated upon by the valve disc are continuously abraded at substantially the same rate as the portion in contact with the valve disc, thereby maintaining the lap in its original condition throughout an indefinite number of cycles. A feature of this invention is the provision of means for holding one or more valve discs or the like on the lap while a shoulder or the like on each valve disc is being lapped.

These and other objects and features of this invention will become apparent from the follow-

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ing detailed description when taken together with the accompanying drawings, in which

Fig. 1 is a fragmentary plan view of a lap on which is placed a valve disc with a sealing surface to be lapped, the surface being located axially inwardly from the end of the disc; and

Fig. 2 is a fragmentary elevation in section taken along the line 2—2 of Fig. 1.

Referring now to the drawings, there is shown in Fig. 2 a valve disc 10 having a flange or shoulder 11 intermediate the ends thereof, said shoulder extending radially outwardly and terminating in an annular bead 12. A radially disposed surface 13 on bead 12 constitutes the sealing surface of the valve disc. Said surface is designed to cooperate with a mating radially disposed surface (not shown) in a valve body to provide a fluid-tight seal therebetween and hence must be perfectly flat and smooth. Extending axially beyond surface 13 is a rounded portion 14 on the valve disc which normally protrudes into the fluid stream passing through the valve and assists in promoting a smooth flow of the stream through the valve to minimize cavitation and other detrimental effects. The opposite end 15 of the valve has a recess 16 which may be round and machined for attachment to the valve stem. The exact construction of the various elements of the valve disc are not material to this invention other than that surface 13 is spaced axially from ends 14 and 15.

The lap by which the valve disc 10 is lapped in accordance with this invention is comprised of a circular plate 17 (Figs. 1 and 2) having a raised annular region 18 near the center thereof and another raised annular region 19 adjacent the perimeter thereof, the surfaces 20 and 21 of which lie in a common plane and are perfectly flat and smooth except for radially disposed grooves 29 which serve to carry away excess grit and the cuttings. The space 22 between the raised regions 18 and 19 constitutes a continuous groove into which extension 14 of the valve disc 10 protrudes. The bottom of the groove, however, does not contact extension 14 at any time. Valve disc 10 is supported on surfaces 20 and 21 of raised sections 18 and 19 by bead 12, surface 13 thereof resting directly on surfaces 20 and 21 and bridging groove 22. Suitable means (not shown) are provided to rotate lap 17 about its center during the lapping cycle.

Thus, it is obvious that the valve disc 10 will be operated upon by the lap 17 solely at surface 13, and when disc 10 is suitably rotated so that the portions of surface 13 bridging groove 20 may be turned to contact raised regions 18 and 19, all parts of the valve disc surface 13 will be operated upon by the lap 17.

The plane of raised regions 18 and 19 is maintained flat by means of one or more rings 23

which encircles valve disc 10 and rests upon the said regions. The ring 23 serves to wear the raised regions 18 and 19 at a higher rate than does surface 13 of disc 10 so that said regions 18 and 19 are maintained in their initial condition indefinitely. It should be noted that ring 23 has a surface 24 which operates upon those portions of raised regions 18 and 19 not contacted by surface 13 and hence any tendency to groove the lap 17 by surface 13 is immediately eliminated. To insure this desirable effect, a weight 25 is placed on ring 23 so that the unit pressure exerted by ring 23 and weight 25 is greater than the unit pressure produced by valve disc 10. Said weight 25 is recessed at 26 so as to provide a shoulder for centering it with respect to ring 23, and both the weight and ring are thus constrained to move together in a lateral direction.

It is contemplated that more than one valve disc 10 will be lapped at a time and accordingly as many such discs 10 and rings 23 may be placed on the lap 17 as space will permit.

Weight 25 is restrained against movement with lap 17 by means of a pin 27 which may be held in a fixed part of the machine frame shown schematically at 28. Said pin 27 may be raised or lowered relative to the frame 28 to enable the operator to remove weight 25 from ring 23, thereby gaining access to valve disc 10 to remove said disc from the lap or to insert one to be lapped.

The rotation of lap 17 about its axis causes different portions of the lap surface to be presented to surface 13 on disc 10 in accordance with good lapping practice. This rotation also induces a rotation in the ring 23 and weight 25 about pin 27. Valve disc 10 must also be rotated and this action is effected by means of a guide plate 30 which is secured by a nut 31 to the lower end of pin 27. Said plate 30 holds the disc 10 against movement with the lap 17 and also holds the disc 10 away from ring 23, thereby preventing a tilting of the disc 10. For greater freedom of rotation, plate 30 may be mounted loosely to avoid any interference with the rotation of disc 10. For valve discs which are not very high, plate 30 may be dispensed with and the disc will then be in contact with ring 13 during the lapping operation.

Thus there is produced a rotation of disc 10 about its axis simultaneously with the rotation of lap 17 together with the rotation of ring 23 about pin 27, all of which insures a continuous wearing of lap 17 at raised regions 18 and 19 which in turn results in, first of all, a lapping of surface 13 to the desired flatness and, secondly, a continuous conditioning of raised regions 18 and 19 by ring 23.

It is apparent from the foregoing that there has been provided a means for automatically lapping shoulders or the like on valve discs or similar objects, which is automatic and results in the least localized wear on the lap. Furthermore, the lapping operation is automatic and it prevents, as far as can be reasonably determined, the formation of a definite wear pattern on the lap which would be detrimental to the quality of the finished surface on the said discs or shouldered objects.

It is understood that the foregoing description is illustrative of preferred embodiments of this invention and that the scope of the invention is not to be limited thereto, but is to be determined by the appended claims.

What is claimed is:

1. Apparatus for lapping a surface on a shoulder of a valve disc or the like, said apparatus comprising a circular lap having at least one groove formed in the operative surface thereof, said groove being concentrically disposed with respect to the lap and of sufficient width and depth to receive the portion of the valve disc extending beyond the shoulder, a ring encircling the valve disc and resting upon the operative surface of the lap, a weight on the ring, said weight being recessed to receive the ring and said weight having a centrally disposed opening, a pin loosely fitted into the opening to permit rotation of the weight about the pin, and means for holding the pin against movement with the lap.

2. Apparatus for finishing a surface on a shoulder or the like of an article, said article having a central opening therein, said apparatus comprising a rotatable lap having an annular groove to receive an article with the portion thereof extending beyond the shoulder disposed in the groove, guide means extending into the central opening in the article, a conditioning ring resting on the lap and encircling the article, a weight on the ring, locating means between the weight and ring to fix the position of the ring relative to the weight, means on the weight for fixing the position of the guide means relative to the weight, and means also on the weight for holding the ring against revolution with the lap.

3. Apparatus for finishing a surface on a shoulder or the like of an article, said article having a central opening therein, said apparatus comprising a rotatable finishing lap having an annular groove to receive an article with the portion of said article extending beyond the shoulder disposed in the groove, a frame member extending over the lap, a pin in the frame member, a plate rotatably mounted on said pin and extending into the central opening in the article to hold the article against revolution with the lap, a conditioning ring on the lap and means for rotatably mounting the ring on the said pin, said means for rotatably mounting the ring on the said pin comprising a weight extending over the ring and having a shoulder for centering said weight on the ring and a central opening through which the said pin passes.

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