

RADLAP PRINCIPLE AND METHOD OF USE

This radius tool lapping device has two features which are either singly or in conjunction with each other, unique in equipment of this nature and they are as follow :-

Feature 1 :- Method of setting the focal point or dead centre of radius to the cutting plane or wheel face.

This is done by utilising the "hickey" or reference sphere principle which enables one to pick up a point on a inclined axis in both lateral and upward directions.

Feature 2 :- To permit a radius to be formed which must blend with two angular cutting edges which have dissimilar clearances. The tool to be lapped is held in a cylindrical cartridge which is angularly graduated and adjustable. This means that planes parallel to a major axis in tool, can be altered, independent of planes at right or other angles to it. Therefore, if say a tool is required to have a front edge clearance of 3° and a side edge clearance of 6° then one sets 3° on main scale which will be operative for both reliefs. Now in order to achieve 6° on the side edge it will be necessary to rotate the cylindrical tool holding cartridge, a further 3° making 6° total inclination in the one plane only, Naturally, if it is necessary for the side clearance angle to be less than 3° , say $1^{\circ} - 30'$ then the tool holding cartridge will need to be rotated $1^{\circ} - 30'$ in the opposite or subtracting direction. From this it is easy to see that clearances which vary from positive to negative can be accommodated, as can, of course, continuous similar or variable positive clearances and the same in negative form.

METHOD OF USE

Decide on tool geometry required and wither tabulate or memorise preferably in the following order.

REQUIREMENTS

Front clearance	say 2°
Side clearance	say 6°
Front Trail Angle	say 5°
Approch Angle	say 0°
Nose Radius	say .100"

Now insert tool correctly located, in toolholder cartridge and secure by means of any or all of the four toolscrews provided, making sure that a protrusion of tool of the order of 2" from front of toolbox cartridge is maintained. This will permit easy access to tool point for diamond wheel and ensure all parts of Radlap are well clear of wheel etc. during the lapping operation.

Using knurled feed knobs, activate compound slides so that the tool point is around $\frac{1}{8}$ " clear of the circumference of setting pin bore which goes through axis of pivot bearing.

For "Front Clearance" set tilt angle by reading graduation 2° through window in tilt bracket casting tail for "requirement" 2° .

For "Side Clearance" set 4° positive on cylindrical tool holding cartridge scale, this will give $4^{\circ} + 2^{\circ}$ previously set = 6° for "requirement" 6° .

For "Front Trail Angle" set 5° upon graduated quadrant by moving rearmost adjustable quadrant stop to 5° and locking, for "requirement" 5° .

For "Approach Angle" set 0° upon graduated quadrant by moving front adjustable quadrant stop 0° and locking, for "requirement" 0° .

You have now set for Front Clearance, Side Clearance, Front Trail and Approach Angle "requirements" and apart from lapping there remain only the setting of reference sphere to cutting plane and then adjusting by feed thimble to bring trunnion axis into correct relationship with cutting plane to provide the required radius.

To set the reference sphere simply insert split tail of shank into the bore which passes through Radlap trunnion axis, pushing it downwards until the horizontal flat; ground across a major axis of the .500" diameter sphere, is adjacent to and co-planar with, the top face of tool to be lapped. In the case of tools with severe top rake a little thought will prove it is necessary to set this reference ball twice when starting to produce a large radius on a sharp cornered tool, for as the formation of the radius progresses so will the height of the top face alter due to severe top rake.

When reference flat and top face are co-planar and in close proximity, slide the whole Radlap including the pivot bracket along the feed shaft until the .500" hickey ball is a few thousandths of an inch from face of cutting plane. Now lock a assembly securely on feed shaft by means of the Kipp handles at front of pivot bracket. This should be very firmly done and from now on not moved until operation is over. Tighten double stop at right hand end of Feed Shaft by means of the Kipp Handle provided, making sure that the reference sphere remains positioned within the confines of the diamond band, cutting plane width. Two set screws in double stop will assist in achieving this. N.B. (Here it is most important to ensure that the gap between the double stop casting and the adjacent Feed Shaft bearing bracket is greater than the movement necessary to achieve radius desired. In practice a gap of $\frac{1}{2}'' - \frac{3}{4}''$ is safe and sensible. Care should be taken also to ensure that the gap between the shoulder formed by the change of diameter from 1" to $\frac{3}{4}''$ on feed shaft, is no greater than around $\frac{1}{4}''$ and no less than say $\frac{1}{8}''$ or difficulty will be encountered when setting focal point.)

Now insert a feeler (say .002") in gap between diamond wheel cutting face and reference ball and adjust on Feed Shaft feed thimble until a "feel" is achieved between them. Note reading on feed thimble.

Feed thimble has 25 x .001" graduations per revolution, therefore, since the reference ball is .500" diameter its radius or distance to centre is equal to .250". Now if we rotate the feed thimble ten times +.002" we shall move the centre of rotation of Radlap into a position which is coincident with the cutting plane which is a point of zero radius generation. Therefore, to generate .100" radius as in "requirements"; the centre of rotation must remain .100" from cutting plane. .100" is equal to four complete revolutions of Feed Thimble. So we remove reference spheres from location, rotate feed thimble (10 turns +.002") - 4 turns = 6 turns +.002 and our centre of rotation is now .100" from the cutting plane (diamond facing).

We must from now NEVER MOVE the feed thimble or all is lost. Adjustments from now on can only be made on the two compound slides, for it is simply necessary to bring the tool edges towards the cutting plane consistent with achieving the clean up on edges and radius as required.

Now lap front edge, then approach edge, with toolblock rotated into firm, "hand held" contact with 5° and 0° quadrant stops respectively. Take care to pass the whole of the carbide edge across diamond facing. It will be necessary to slacken the Kipp Handle on Double Stop to achieve this. Support Radlap assembly while so doing.

In the case of producing a radius from a sharp corner, you will appreciate this will mean a fair amount of metal removal and this will be best achieved by generating a series of flats between the 5° and 0° settings and then rotating between stops to finalise. Sometimes, you will prefer to re-finish front clearance and side clearance edges and included radius by putting on extra say .001" feed on each of the compound slide settings.

IMPORTANT POINTS

1. Diamond wheel or grinding wheel :- This must have an absolutely flat working face or a mal-formed radius will be obtained.
2. Do not be tempted to choose too fine a diamond wheel where areas of tool to wheel face contact varies. Remember that area in contact is equal to: wheel band width x depth of tool on the Front Clearance and Approach Angle lapping, but when lapping the radius between, you have knife edge and tool depth area of contact which results in faster cutting and can "depress" radius between flanking angles. 180 - 240 grit recommended.
3. Avoid the temptation to "feed on" by Feed thimble, for this is used for centre of rotation setting only on Tiplap for Radius lapping purposes.
4. Attention should be given to gib strip tension on compound slides, these should be so set that slide movement tends more to tight, than slack. Any slackness will produce malformed radii.