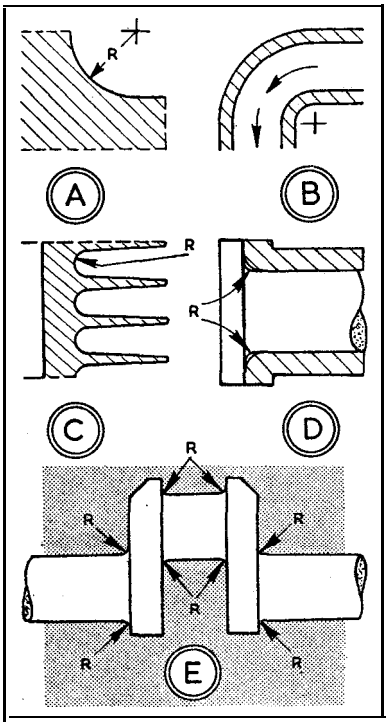
By Geometer

Radii — functions and checking

FOR THE REASON that it is so easily specified, a radius is generally chosen in mechanical design as the junction between converging lines or surfaces as an alternative to a sharp corner-or a more complicated curve as may be employed in special circumstances. Specification of a radius is always as ***A,*** where it is only necessary to substitute a dimension for ***R.***

A radius, however, is more than a simple academic contrivance, a feature of basic geometry, for the curve it, specifies is often essential for efficient functioning of the machine or component. Generally, it is indispensable for changing the direction of flow of gases or fluids in passages, for conduction of heat from surfaces and for strength in areas of stress in components.

Thus. as at ***B,*** a right-angle curve in a pipe introduces little more resistance than a continuous straight flow; whereas if the bend is a sharp comer, the edges set up minor contrary flows or eddies.



Where the flow is of heat from a part as from a cylinder to its cooling fins-the rate of flow is generally best where the fins, as at C, join the barrel with a root radius and are tapered out to their tips. This is apart from the necessity for radiused and tapered fins for moulding and casting the cylinder.

The flow being of stress, as when a component is strained under load, strength is always improved by employing a radius rather than a sharp corner where there is a sudden change of shape or section. Consequently, shafts terminating at flanges, as at 0, and joining to webs in the case of crankshafts, as at ***E,*** always carry radii.

Rough radii are fairly easily formed, as on the square end of a piece of metal such as a clip, when a file is used to round it. Working more precisely, dividers can be used to scribe the radii, leaving lines to file. A single clip will thus gain in appearance? and should there be several they will be reasonably alike. Filing can be more accurate still, if a steel disc (diameter twice the required radius and preferably hardened) is clamped to the metal or held with it in the vice.

Small radii as left in machining processes are provided by suitably rounding the turning tools-as on shafts ***D*** and ***E.*** Then it is necessary for the tools to be ground to the required radii for reproduction on the shafts.

Checking of such small radii is done with gauges as at F-a holder containing a range of sizes from about 1/32in. to 1/4in. The appropriate one is presented for comparison to the tool or to the work when, if necessary, holding up to a light will better reveal the fit. An incorrect turning tool may then be rectified by using a hand abrasive stone.

Particular care is necessary when, as at ***D,*** a shaft has a radius fitting in a bearing. Either the end of the bearing must carry a larger radius or be chamfered or counter-bored clear of the shaft, otherwise there will be to some extent the condition of " riding " on the radius. In fitting in such a case, the shaft radius would be checked with the gauge at ***F,*** and a larger one selected for the bearing as it is scraped to clear.

Radius gauges similar to but larger than the standard type, ***F,*** can be produced by drilling and filing from plate material (1/16 in. to 1/8 in. thick). For the internal radius a hole can be drilled or drilled and reamed, and the surplus material sawn and carefully filed away, G. For the external radius, ***H,*** a hardened disc can be used as a filing guide. If the material is square the disc can be aligned, holding a straight-edge along each edge in turn or using a small square,

For checking ball components, a hole in a plate gauge need only be relieved clear of the shanks, I; and in production gauges of this type there may be two holes, one " Go," the other " Not Go."

Attaching a handle with a central screw facilitates use of the radius gauge at J, a disc parted'or sawn from steel bar previously machined to size.