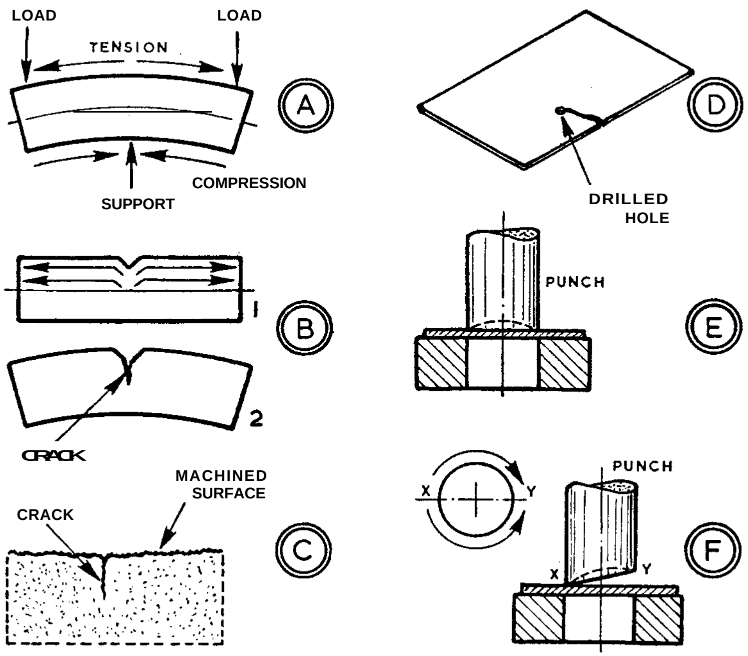
CRACK and SHEAR Relationship

WORKSHOP HINTS and TIPS

By GEOMETER



THE manner in which components or material may be broken or torn without intention, is closely related to ways in which material may be deliberately sheared in workshop operations. The principle of each operation is very similar-advance by degrees to arrive at an end otherwise unattainable ; advance in the one case of a defect or crack through a component or material, and in the other of tools like scissors, snips, chisels, or shearing punches.

Usually, of course, workshop processes are accepted without reflection, or quickly dismissed as " obvious " --though the reason may not be immediately clear. If, for instance, one is chiselling a length of plate it will be found that, for a given blow, a cold chisel of moderate width will cut better and sink deeper than a broader one. Being longer the instantaneous cut of the latter meets greater resistance. Again, in the absence of a progressive cutting action, tools like scissors and snips could not be used. If the cutting edges came together immediately over the full length, they would meet too much resistance for hand tools.

This principle of progressive advance applies not only to actual cutting, but also to splitting, tearing and cracking. Relatively soft materials such as wood and paper, may be split or torn by running a fissure through them-where they could resist a total attack. In the case of hard materials which can be subject to cracking, surface finish can be a vital factor-glass is an outstanding example. Scratch the surface with a diamond or cutter and with a light tap or moderate bending a fissure can be run right through.

Although that is an extreme example it is not without parallel in engine or machine components. There the danger may be that a crack can develop from a surface defect, and y insidious advance creep through and weaken the material to the point where the remainder may suddenly break.

Circumstances leading to this are loading of parts by direct heavy tension, bending, shock or vibration -aided by any surface defect. Loading a part, as at *A,* gives tension one side of the centre line, compression the other, and with good design and finish the part will function without fail. But any groove or defect, as at Bl, directs stress towards the centre line where there is less resistance. If the part is sufficiently loaded, a crack develops and runs through, as at B2. This may be done deliberately and quickly, as in the case of glass cutting, or when a groove is ground in hard tool steel for it to be broken in a vice from a hammer blow.

From this point of view, a high surface finish is desirable if not imperative in the case of highly stressed engine and machine parts-since ordinary machined surfaces contain irregularities from which a crack may develop,. as at C. Grinding, lapping and polishmg operations considerably increase resistance to crack formation from the smooth continuous surfaces presented, while burnishing and shot-peening have similar effects by closing the surfaces-the last often being employed for connecting rods in " hotted up " i.c. engines.

When a crack develops in sheet or plate material, it may often be arrested, as at D, its further progress being prevented by drilling a hole which directs stress from the advancing point round the smooth continuous surface.

From the aspect of progressive advance in workshop processes like punching, even where power is available, a shearing principle can reduce shock and admit of working to larger dimensions than would otherwise be the case. As an example, a circular flat punch, as at *E,* makes instantaneous contact with the material, shearing the whole perimeter of a blank at once, with considerable shock. By sloping the end, as at *F,* contact is made progressively from x round to y, and either shock is reduced, or it is possible to accommodate larger work.