PIN CONNECTIONS AND FAILURE OF BOLTED JOINTS

PIN CONNECTIONS

When two structural members are connected by means of a cylindrical shaped pin, the connection is called a pin connection. Pins are manufactured from mild steel bars with diameters ranging from 9 to 330 mm. Pin connections are provided when hinged joints are required, i.e., for the connection where zero moment of free rotation is desired. Introduction of a hinge simplifies the analysis by reducing indeterminacy. These also reduce the secondary stresses. These connections cannot resist longitudinal tension. For satisfactory working it is necessary to minimize the friction between the and members connected. High grade machining is done to make the pin and pin hole surface smooth and frictionless. Pins are provided in the following cases:

1. Tie rod connections water tanks and elevated bins
2. As diagonal bracing connections in beams and columns
3. Truss bridge girders
4. Hinged arches
5. Chain-link cables suspension bridges

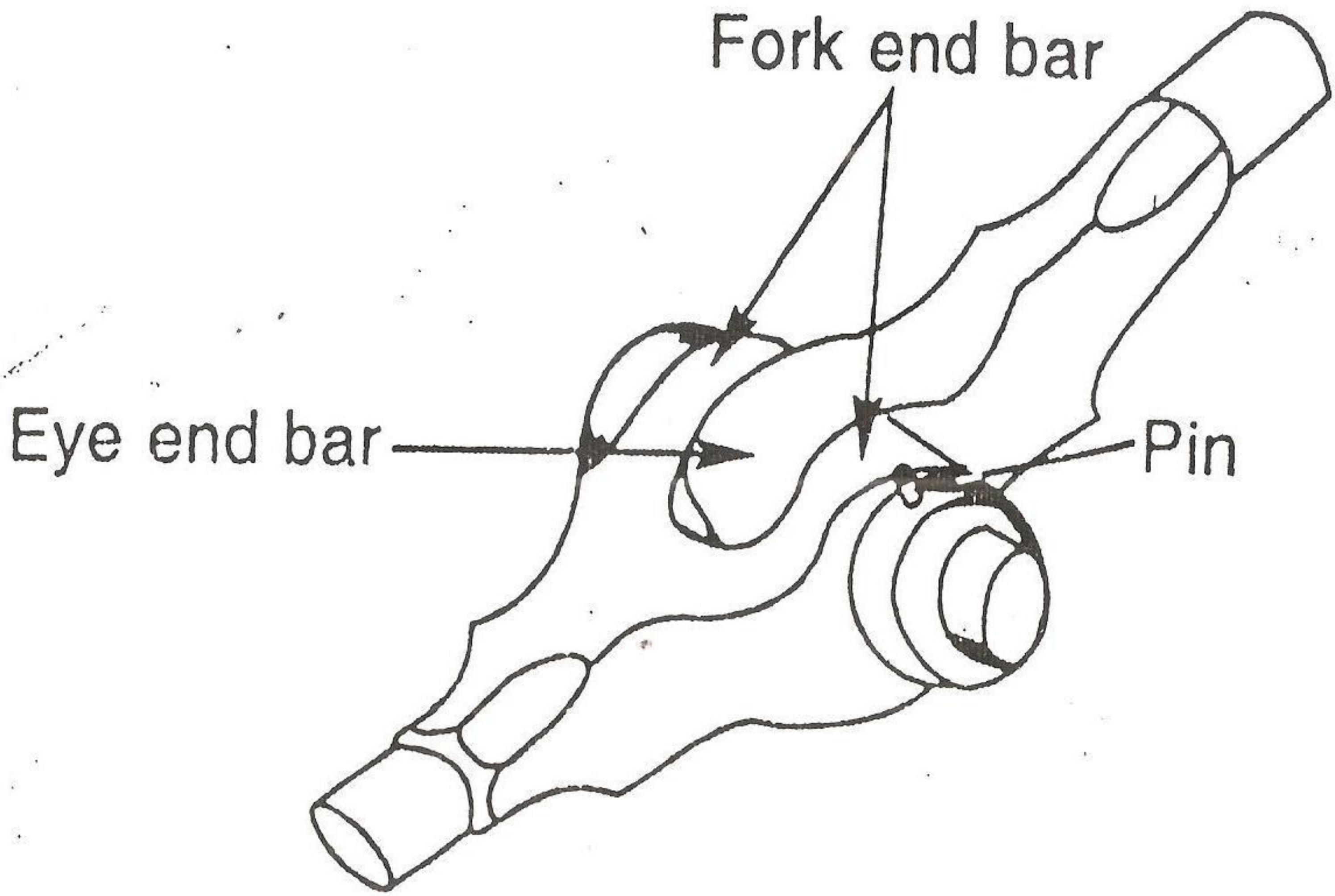

Fig. 2.13 Pin Connection

Various types of pins used for making the connections are forged steel pin, undrilled pin and dilled pin. To make a pin connection, one end of the bar is forged like a fork and a hole is drilled in this portion. The end of the other bar to be connected is also forged and an eye is made. A hole is drilled into it in such a way that it matches with the hole on the fork end bar. The eye bar is inserted in the jaws of the fork end and a pin is placed. Both the forged ends are made octagonal for a good grip. The pin in the joint is secured by means of a cotter pin or screw, as shown in Fig. 2.13.

FAILURE OF BOLTED JOINTS

The bolted joint may fail in any of the following six ways, out of which some failures can be checked by adherence to the specifications of edge distance. Therefore, they are not of much importance, whereas the others require due consideration.

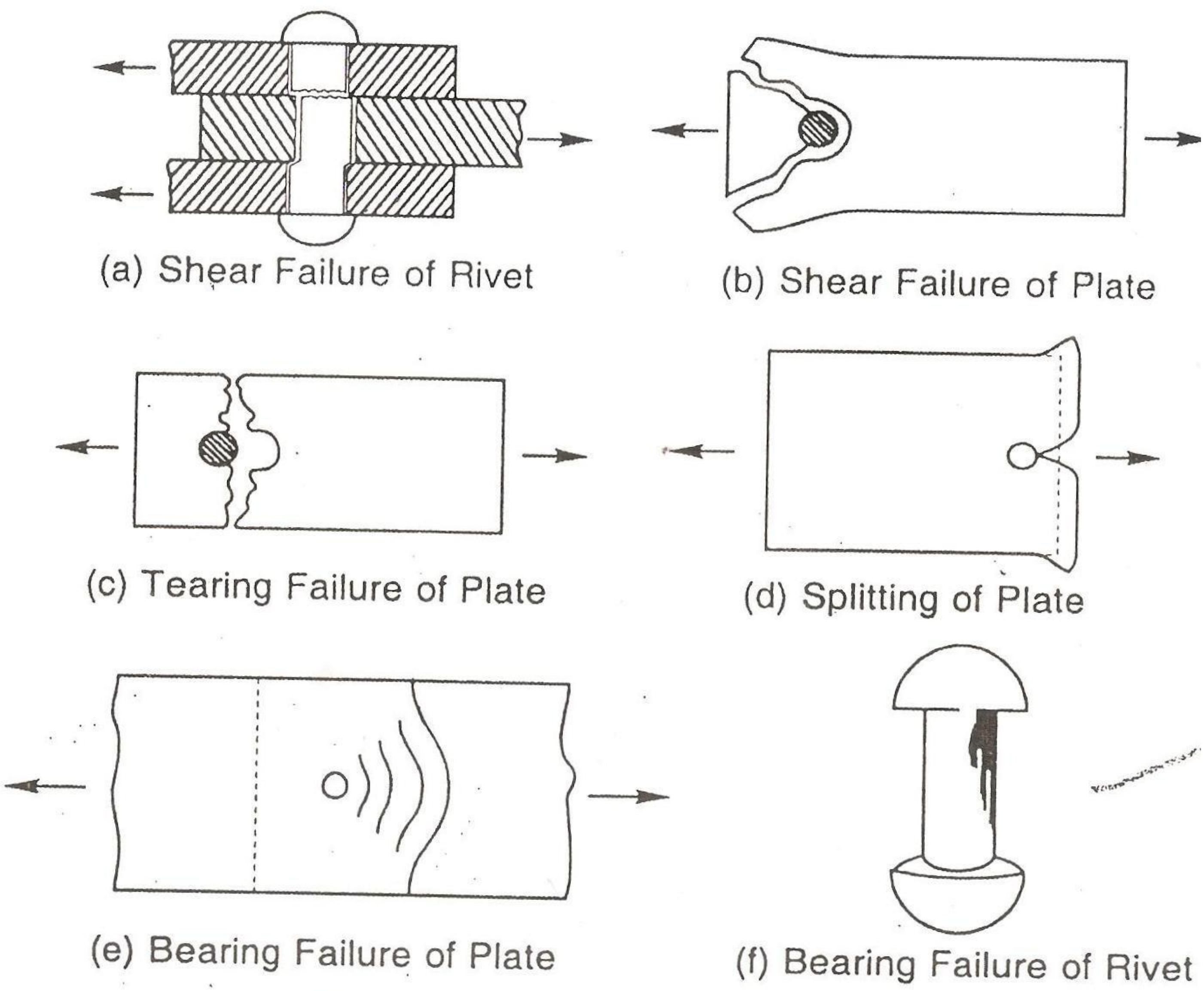

Fig. 2.3 Failure of Riveted Joints

Shear failure of bolts (Fig. 2.3 (a))
The shear stress in the bolt may exceed the working shear stress in the bolt. Shear stresses are generated because the plates slip due to applied forces.

Shear failure of plates (Fig. 2.3(b))
The internal pressure of overdriven (shank length more than the grip) bolts placed at a lesser edge distance than specified causes this failure. This can be checked by providing proper edge distance between the center of the hole and the end of the plate as specified by I.S.800.

Tension or tearing failure of plates (Fig. 2.3(c))
The tensile stress in the plate at the net cross-section may exceed the working tensile stress. Tearing failure occurs when bolts are stronger than the plates.

Splitting of plates (Fig. 2.3(d))
Bolts may have been placed at a lesser edge distance than required causing the plates to splitor shear out.

Bearing failure of plates (Fig. 2.3(e))

The plate may be crushed when the bearing stress in the plate exceeds the working bearing stress.

Bearing failure of bolts
The bolt is crushed around the half circumference. The plate may be strong in bearing and the heaviest stressed plate may press the bolt.

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