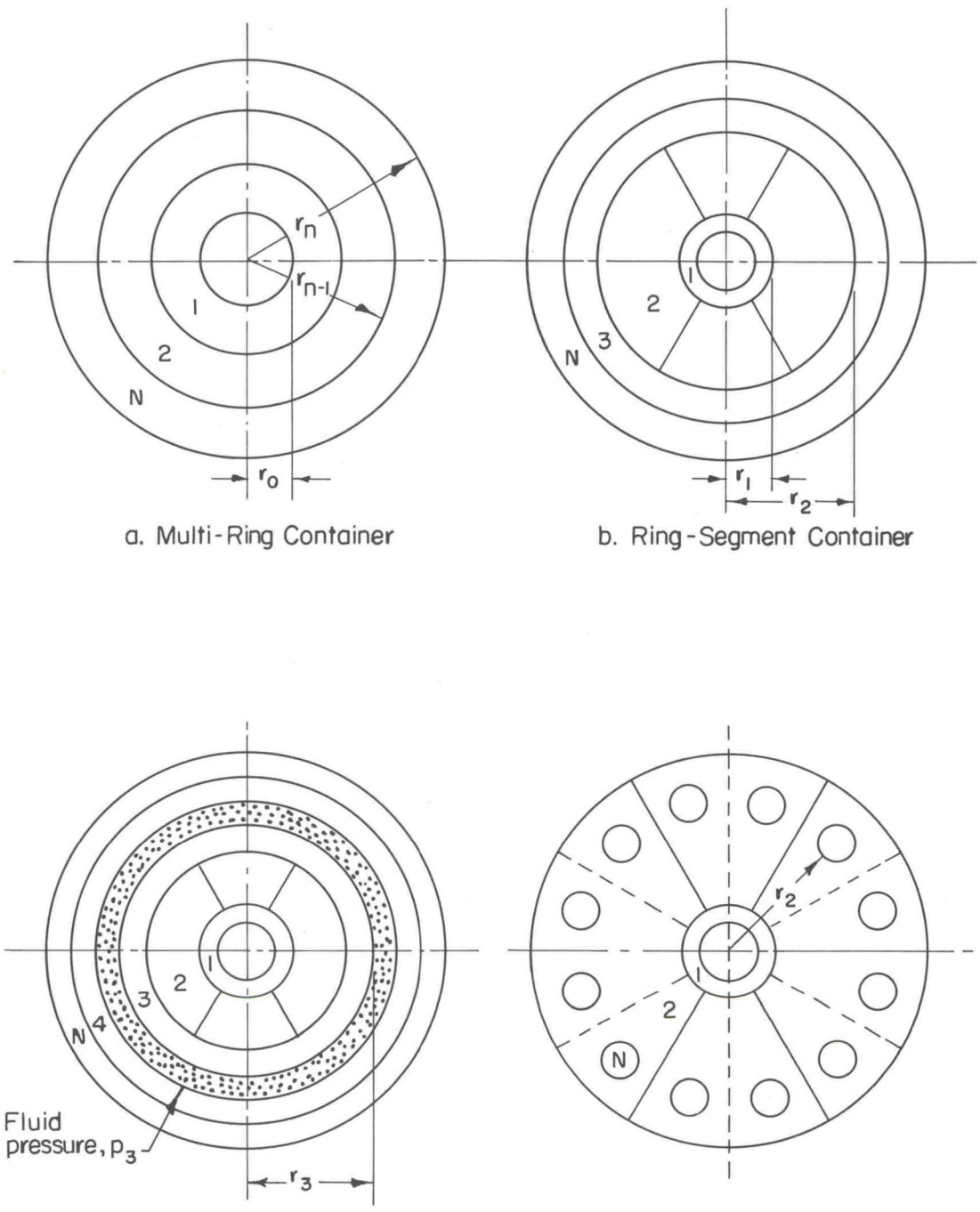

FIGURE 2. NOTATIONS USED FOR ANALYSIS OF CONTAINER DESIGN CONCEPTS

(from operating temperature to room temperature) upon the prestresses (residual stresses) is investigated. Excessive residual stresses may result because of differences in thermal expansion of the component parts of each container.

DEFINITION OF PARAMETERS

The components of each design are identified from the inside out by the numbers 1, 2, 3, ..., N. N refers to the outermost components. As indicated in Figure 2, the components have the following radii:

$$\begin{aligned} r_0,\ r_1 &= \text{inner and outer radii, respectively, of component 1, the liner,} \\ r_{n-1},\ r_n &= \text{inner and outer radii, respectively, of component n, n = 1, 2, ..., N.} \end{aligned} \tag{1}$$

For the multi-ring container all the components are circular hollow cylinders. For the ring-segment and ring-fluid-segment containers, component 2 refers to the segments. The only exception to the notation on the radii occurs in the pin-segment design where the segment is divided for analysis into two parts and where r_2 is the radius to the inside of pins as shown in Figure 2(d).

The bore pressure is identified as follows:

$$p = \text{internal, bore pressure on liner.} \tag{2}$$

Wall ratios for each component are defined as follows:

$$k_n \equiv \frac{r_n}{r_{n-1}} \tag{3}$$

where k_n is the wall ratio for component n. The over-all diameter ratio of the container is defined as

$$K \equiv \frac{r_N}{r_o} \tag{4}$$

FATIGUE CRITERIA

Two fatigue criteria are formulated here in order that both relatively low-strength ductile materials and high-strength, more brittle materials may be used in one design. The intention is to use high-strength steels as liner materials and lower strength ductile steels for the outer cylinders in order to prevent catastrophic brittle failure.

Fatigue Criterion for Ductile Outer Cylinders

From both torsion and triaxial fatigue tests on low-strength (120 to 150 ksi ultimate strength) steels conducted by Morrison, Crossland, and Parry[10] it is concluded that a shear criterion applies. Therefore, a shear theory of failure is assumed for outer rings made of ductile steel.