the notion of ε_t as follows; we consider the moment when radius r has become equal to s ($s < u$); at the moment when s has become $s + \delta s$, the length of the circumference, of which the radius is equal to s, is strained by $\delta \varepsilon_t = (\delta s)/s = \delta \log s$. The density being constant, one can write : $(1 + \delta \varepsilon_t)(1 + \delta \varepsilon_r) = 1$ that is to say : $\delta \varepsilon_r = - \delta \varepsilon_t$. On the other side, the shear strain δ_y may be defined by the egality : $\delta_y = \delta(\varepsilon_t - \varepsilon_r) = 2 \delta \log s$, which may be integrated as follows

$$\gamma = 2\int_r^{r+u} \delta \log s = 2 \log \left[1 + \frac{u}{r}\right].$$

The fifth column of table 3 is this one of the so-called "natural shear strains". The shear strains in the cylindrical wall are then compared with torsion test shear strains. By making use of Manning's hypothesis (c), it becomes then possible, to fill the sixth column of table 3 as well as the following column. In fact the figures put in the sixth column are fictitious ones but their presence is necessary to get a clear insight into the matter.

Eq. (27) shows, that following relation is absolutely true

$$p_{2.2271} - p_{2.2913} = 2\int_{2.2271}^{2.2913} \frac{\tau}{r+u}\, \mathrm{d}\,(r+u)$$

$$= 2\,\overline{\left(\frac{\tau}{r+u}\right)}\,(2.2913 - 2.2271).$$

If we assume, that the true mean of $\tau/(r + u)$ is equal to its arithmetical mean $\frac{1}{2}$ (5.02 + 5.30) following relation is then only approximately true

$$p_{2.2271} = p_{2.2913} + (5.02 + 5.30)\,(2.2913 - 2.2271) = p_{2.2913} + 0.662$$

Let us now consider the case of a cylindrical wall, of which the initial radii are respectively 1 and 15 and of which the inner radius has undergone the strong displacement $u_1 = 1$, because the inner surface of the cylindrical wall has been submitted to an internal pressure p_1 still unknown. One puts down $p_{2.2913} = 0$ and thus $p_{2.2271} = 0.662$. One can write

$$\begin{aligned} p_{2.1656} &= p_{2.2271} + (5.30 + 5.59)\,(2.2271 - 2.1656) \\ &= p_{2.2271} + 0.670 = 0.662 + 0.670 \end{aligned}$$

and so on. Figures 0.662, 0.670 etc... are put down in the eighth column of table 3, from the bottom upwards. The last column contains the cumulated sums of these figures, put down from the bottom upwards. This last column shows us, which are the pressures existing in the wall and particularly shows, that the internal pressure is equal to 3.30. Stress σ_t, is calculated by making use of following relation $\sigma_t = 2\tau + \sigma_r = 2\tau - p$. The problem is thus solved, provided that stress σ_z is overlooked.

In the earlier version of his method, MANNING [1945] has shown on a concrete example, how it is possible to predetermine the ultimate pressure p_{1u}, a cylinder is submitted to, before bursting. By considering increasing displacements u_1 of the inner radius and by computing for each of the displacements the internal pressure by means of a table, it has been found, that from a certain value of u_1, onwards, pressure p_1 decreases, passing thus through a maximum, which is identified with p_{1u}. This is obviously a tedious and time consuming method.

The improved version [1957] of this method is based on table 3, extended up to $r_2 = 28$ for instance, which is indeed a very high value of the k ratio. The external pressure corresponding to $r_2 = 28$ being assumed to be equal to zero, the other pressures are calculated by making summations up to the inner radius. At a certain place, the pressure will be found equal to τ_y (1-1/28^2) which is the critical yield pressure according to eq. (15). Such a place is thus the boundary between the elastic zone and the plastic one. An example of such a table in which radius r takes all the values between 1 and 28 has been given by CROSSLAND, JÖRGENSEN and BONES [1958]. A diagram has been plotted by utilizing the data of this table and a curve obtained, which is shown qualitatively on fig. 8 and for convenience sake a logarithmic scale has been used for representing the abcissae.

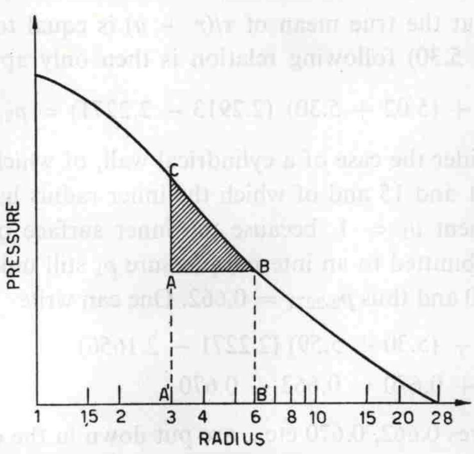

Fig. 8.

We will now try to predetermine the ultimate pressure p_{1u}, which a wall with a k ratio equal to 2 is submitted to. By moving from right to left