ELASTIC DEFORMATION. Starting with the condition in which some asperities just barely touch, let us apply a gradually increasing force (P) to these members. The asperities will deform and new asperities will begin to touch. At first the deformation (strain) is elastic, i.e., it would disappear if the stress were removed. The sum of the areas of all these tiny spots will be just large enough to support the applied load. In the cases where the *macroscopic* shape of the members would tend to produce round strained areas (assuming for a moment that perfect contours are present without asperities) the radius, a, of the *equivalent load bearing area can be calculated by*

$$a = 0.087 \sqrt[3]{Pr\left(\frac{1}{E_1} + \frac{1}{E_2}\right)} \qquad \text{Eq. 1.1}$$

where in the metric system a = radius in millimeters

P = force in grams
r = contact radius in millimeters
E_1, E_2 = Modulus of elasticity in kilograms/mm^2

In engineering units common in the United States the equation becomes

$$a = 0.11 \sqrt[3]{Pr\left(\frac{1}{E_1} + \frac{1}{E_2}\right)} \qquad \text{Eq. 1.1a}$$

where

a = radius in inches
P = force in grams

r = contact radius in inches
E_1, E_2 = Modulus of elasticity in psi

Since the *equivalent area* is πa^2, we see that the load supporting area is proportional to $P^{2/3}$ when deformation is wholly elastic.

The concept of equivalent area is illustrated in Fig. 1-3. We solve for (a) however, because it will be used later in the formulas for electrical contact resistance.

Equations 1.1 and l.la can be used for contact pairs of a spherical member against a flat, crossed round wires of equal diameters, or any configuration that would produce an *equivalent* load bearing area whose shape comes close to being round.

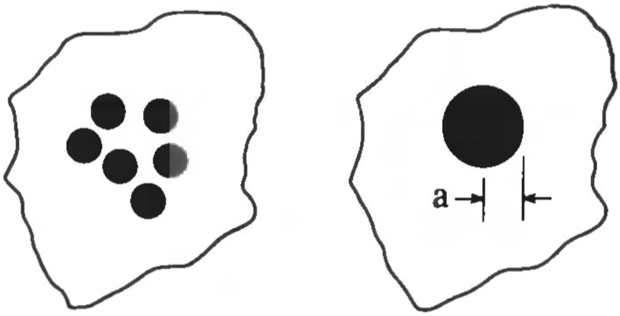

Fig. 1-3. Equivalent area of radius (a) equals sum of smaller black areas.