Figure 10.6
Lines of equal values of complex search characteristics I_1 and I_2.

the constant α cannot be included into the set of basic values of this characteristic. Indeed, during a search process the characteristic $F(R, P)$ may reach a value equal to α, but the point corresponding to the recall–precision pair will not belong to the domain of applicability of the complex search characteristic $F(R, P)$; that is, this characteristic cannot serve as the basis for a pragmatically justified evaluation of the document search functional effectiveness.

This allows us to determine the sets of basic values of complex search characteristics I_1 and I_2 in the cases of the boundaries of the domains of applicability of these CSCs that we have defined. These sets are as follows: for I_1, interval [1.5, 2], that is, $1.5 \le \alpha \le 2$; and for I_2 interval [$\sqrt{0.5}$, 1], that is, $\sqrt{0.5} \le \alpha \le 1$. Thus, with complex search characteristic I_1 values within the interval [1.5, 2] or with complex search characteristic I_2 values within the interval [$\sqrt{0.5}$, 1], one is justified in applying the formal method of evaluation of functional effectiveness.

From a practical point of view it is also interesting to answer the following modification of the preceding problem: What values should be reached by a specific complex search characteristic to serve as the basis for a pragmatically justified evaluation of the functional effectiveness of a search, provided its precision is not less than 0.5? In other words, we have to solve the previous problem with the constraint that the precision is not below 0.5. For complex search characteristics I_1 and I_2, the discussed problem can be solved in the same way as the preceding one, but keeping into account the fact that to solve this problem it will be sufficient to consider inclusion of or not the entire equal values lines of the complex search characteristic but only that part of the equal values line that is a set of points having a coordinate of 0.5 or above on the OP-axis. The resulting set for complex search characteristic I_1 is interval [1.3, 2] (see Figure 10.4), whereas for complex search characteristic I_2 it is interval [0.1, 1] (see Figure 10.5).

The results produced are indeed important for practical purposes because they justify the acceptance of the following assumption: if the precision is at least 0.5, then the formal method of evaluating functional effectiveness based on complex search characteristic $I_2 = \sqrt{R \cdot P}$ can be used with any value of this CSC. Recall that in discussing the boundaries of domain of applicability of characteristic I_2 (Figure 10.5), we considered it more precise to specify the limiting line by equation $R \cdot P = \beta$, where β is a constant under 0.01 (and not $R \cdot P = 0.01$). This assumption provides for a simpler solution to the question of whether it is justified to use the formal method of evaluating functional effectiveness based on characteristic I_2: it is sufficient to determine the precision, a procedure known for its simplicity. We will note also that the requirement of obtaining the precision level of at least 0.5 is common in the modern document IR systems. Therefore, one is justified in assuming that the functional effectiveness of the search performed in a modern IR system can, in almost every case, be evaluated by the formal method based on the complex search characteristic I_2.

It follows, therefore, that the limitations to the use of the formal method of evaluation of functional effectiveness, if it is based on characteristic I_2, are quite weak. However, in cases with other CSCs, such limitations may turn out to be more rigid. For example, it is true for the complex search characteristic $F(R, P)$; that is, this characteristic cannot serve as the basis for a pragmatically justified evaluation of the points from the domain of applicability of the CSC I_1. By the way, it is not possible to decide if it is justified to use the formal method of evaluating functional effectiveness based on characteristic I_1 unless the achieved value of the recall is determined. To see this, it will suffice to analyze the domain of applicability of the complex search characteristic I_1 (this is also the case with many other CSCs). At the same time, important for information science, problems of evaluation that are based on the complex search characteristic I_2 can be solved (see Chapter 9) without determination of the recall level. It is this possibility that adds real practical substance to the results produced earlier, which are related to the determination of the justification of using the formal method of evaluating functional effectiveness. Still, it should be pointed out that in evaluating functional effectiveness there are many more situations when one must know the achieved values of the recall than there are cases where it is not needed. Therefore, as we promised earlier, we will discuss the methods of determining recall that are used in information science.

10.5
Determination of Recall

Determination of the accurate value of a recall involves, as is well known, identification of all documents in the collection that, in the opinion of the user, are pertinent to his or her need. In fact, it involves a parallel search by the user.