This invention relates to a process of improving the structure of steel products and especially rails for railroads and street railways, and I-girders.

It has already been proposed for the purpose of improving the structure of parts of steel products such as railroad rails which are subjected to great stress to effect, during the shaping, which is originally existing edges of the ingot, and especially during the rolling process, at the points of the profile or section where an improvement of the structure is to be obtained, a wedge-shaped indentation of the surfaces to be influenced and independently of the final shaping operation. The surface crystallites of the steel are thereby shifted into a position which is almost parallel to the surface of the rolled material. The wedge-shaped indentation is effected independently of the final shaping operation.

This known process proceeds from the fact that during the solidification of steel ingots, which are used as raw material for the manufacture of rolling mill products, a preferred crystal growth perpendicular to the surface of contact takes place and the cooling is effected from these surfaces toward the interior. The crystallites thus formed and directed perpendicular to the surface may be rendered visible in the finished rolled bar by a suitable etching process. The known process has for its object to displace the crystallites preferably in those surfaces which give rise to surface defects or imperfections, so that the shaping of these surfaces rendering a wedge-shaped indentation unnecessary per se.

The present invention pursues the same purpose but allows of this object being attained with simpler means. Now the present invention resides in the fact that the crystallites are shifted into a position almost parallel to the surface during the shaping of the cast or raw ingots into the preliminary workpiece or blank for further treatment, for instance, by rolls. The new process is preferably carried out in such a manner that the cast or raw ingot is shaped by turning it on its corners, for instance, between rolls, so that the originally existing edges of the ingot are shifted into the center of the flat sides of the preliminary workpiece or blank produced whereby the crystallites directed perpendicularly to the flat sides of the raw ingot must occupy a position approximately parallel thereto, that is to say, they are shifted or displaced. The shaping of the cast or raw ingot according to the invention may also be effected by pressing or forging with or without a subsequent rolling out operation.

A constructional example of the invention is shown in the accompanying drawing.

Figure 1 is a cross section of a raw or cast ingot arranged between rolls.

Figure 2 shows an example of another construction for rolling out the raw ingot into a preliminary workpiece or blank.

Figure 3 shows diagrammatically the cross-section of the raw ingot after it has passed through the first pass in Fig. 2.

In Figure 1, a is the raw or cast ingot which is square. It may obviously have any other cross sectional shape or form which is usual for raw or cast ingots, for example, it may also be hexagonal or multangular. b is the top roll and c the bottom roll. The rolling pressure P is indicated by arrows. During the first passage through the rolls b and c the raw ingot receives a hexagonal cross-section; that is, the upper and lower edges as shown in Fig. 1 are formed by pressure into sides so that the cross-section is an irregular hexagon. The ingot is then turned at an angle of 90°. During the second passage through the rolls, the ingot receives a quadrangular cross section d indicated by dotted lines.

According to Fig. 2, the rolling out of the cast or raw ingot is effected in such a manner that only one edge of the ingot is flattened, e is the top roll and f the bottom roll. The rolls are shown in side elevation. The raw ingot passes first into the pass I wherein the lower edge g of the ingot is pressed to a flat side h. After the ingot has passed through the pass I, it enters the pass 2 wherein the edge i opposite the side h is converted into the flat side k. The ingot is now turned at an angle of 90° and passes out of the pass 2 into the pass 3 of the roll. In this pass, the edge l is converted into the flat side m whereupon after the ingot passes through the pass 3 into the pass 4 it receives the square shape d indicated in Fig. 1. It is obvious from Fig. 3 that the crystallites of the side h have received a position which is almost parallel to this side while the crystallites of the other sides are perpendicular to these sides. These crystallites are also shifted or displaced in the passes 2, 3 and 4 so that finally after passing through the pass 4 all crystallites occupy a position which is almost parallel to the surface of the ingot d. The preliminary ingot d is then further rolled in the known manner into rails, I-girders or similar products.

The shaping of the cast or raw ingot according to the invention may also be effected by 55.
pressing or forging with or without a subsequent rolling out operation. The rolling process is, however, preferred.

This shifting or displacement of the crystallites has the great advantage that any surface defects or imperfections of the steel (which are insignificant per se) such as slag inclusions, welded subcutaneous blowholes, so-called scales or the like, which exist in the cast or raw ingot are no longer detrimental. If the original arrangement of the crystallites is maintained perpendicular to the surface of the steel, serious defects arise in the surface of the rail foot and in the surface of the rail head. A change of direction of the surface crystallites of the steel into the position which is most favorable, that is, most undetritmental for the rolled product is rendered possible by the new process.

What is claimed as new and desired to secure by Letters Patent is:

1. The process of treating approximately quadrangular ingots which comprises applying sufficient pressure in planes of the edges and the corresponding axis to so deform the ingot that the edges become the midlines of new faces and each original face forms a part of two adjacent faces substantially at right angles to each other whereby the crystallites over the entire outer surface are shifted into a position which is substantially parallel to the surface.

2. The process of improving the texture of rolling mill products from ingot which comprises applying sufficient pressure to each longitudinal edge formed by two surfaces of said ingot, in the plane extending through said edge and the longitudinal axis of the ingot, to form a new surface of the adjacent portions of said two surfaces, said new surface forming substantial angles with each of said first named surfaces and said edge forming the mid-line of said new surface whereby the crystallites over the entire outer surface are shifted into a position which is substantially parallel to the surface.

3. The process of improving the texture of rolling mill products from ingots which consists in applying to each edge thereof, sufficient pressure in the plane of said edges and the corresponding axis of the ingot, to press adjacent portions of adjacent faces of the ingot into a plane surface of which said edge is the middle line and which plane surface makes a substantial angle with the faces of which it formed a part whereby the crystallites over the entire outer surface are shifted into a position which is substantially parallel to the surface.

4. The process of improving the texture of rolling mill products from ingots which comprises applying sufficient pressure to each longitudinal edge of the ingot in the plane extending through said longitudinal edge and the longitudinal axis of said ingot to press the edge and adjacent portions of the ingot into a plane surface extending at a substantial angle to the former surfaces whereby the crystallites over the entire outer surface are shifted into a position which is substantially parallel to the surface.

FRANZ BARTSCHERER.