Remarks on Special Issue on Railway

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Recently, the railway business has been attracting considerable public attention, as the coverage of Japanese exports of high-speed railway systems and railway rolling stock by the mass media has increased noticeably. Until the integration, the two companies had been deeply involved in the field of railways. In fact, they had been manufacturing railway-related products for many years. In recent years, the former establishment, Nippon Steel Corporation, had been manufacturing rails, and Sumitomo Metal Industries, Ltd. had been fabricating bogies, wheels, etc., for railway rolling stock. Although bogies run on the rails, I have seldom heard of an earnest technical discussion between bogie/wheel engineers and rail engineers. Thus, they were apparently going their own way. Therefore, in this first issue of Shinnittetsu Sumikin Giho, railway was determined to be the point of focus. For this, railway experts were asked to briefly describe the technologies involved in rails and rolling stock components, and mention the direction of the contribution of the above engineers to the progress of railways, if they decide to meet and have serious discussions taking the integration as a good opportunity.

In this preface to the first issue of Shinnittetsu Sumikin Giho, I describe the desired performances of rails and bogies, our activities in the field of railways, and my visualization of the future direction of development of railways.

As for railways, the efficiency of transportation attracts special attention. The high efficiency of railway transportation is attributable to the exceptionally small rolling resistance: the area of contact between the wheel and the rail during train operation is only about the size of a coin. This suggests that railways have little impact on the environment. According to the website of the Ministry of Land, Infrastructure and Transport (Japan), the CO_2 emission from railway transportation of freight is one-sixth that from truck transportation. In America, more and more heavier axle load freight cars have been put into practical use to allow for efficient freight transportation. Thus, a high efficiency of freight transportation is attained by double stack containers. As a result, there are cases in which the wheel load reaches about 20 tons, which is more than twice that for freight cars used in Japan. In view of the growing demand for rails and wheels that are capable of supporting such a heavy axle load, new standards were recently specified in this regard in the U.S. Our company also has been developing new materials and heat-treatment processes for heavier-duty rails and wheels. The demand for higher efficiency of railway transportation will continue to exist. Therefore, a comprehensive study of better materi-

als and shapes of rails and wheels will provide us with a new growth perspective.

What is required of railways the most is the promptness of transportation and the safety of passengers. The world-renowned Shinkansen of Japan is a representative example in which the above requirements are met quite satisfactorily. Established in 1964, the Shinkansen—a dream superexpress train covering Tokyo–Osaka in 3 h and 10 min at a maximum speed of 210 km/h—has long contributed to the development of Japan. At present, the Shinkansen boasts of a high speed of 300 km/h, which is planned to be raised to 320 km/h in the near future. However, it is said that in the early stages of development of high-speed trains, there were cases in which because of excessive vibrations of the rolling stock during high-speed running, the train gradually caused serious damage to the test track. On the other hand, in order to significantly speed up railway vehicles, it is indispensable to adopt a very wide variety of factors—the precisions of track/rails, the characteristics of bogies and motors, the performance of current collectors, etc.—to the desired train speed. In this respect, our research on rolling stock and rails has played an important role. In the case of urban railway, tracks having sharp curves are unavoidable because of space limitations. In such curved sections, the track, bogies, and rails are required to display characteristics that are apparently incompatible with those required for high-speed runs. At present, research on this problem is conducted mainly by rolling stock engineers. In the future, research involving rail engineers might also lead to better results.

From the standpoint of safety and security, there is another requirement—being free from breakdown. Iron is subject to a phenomenon called metallic fatigue. Namely, after being subjected to a load repeatedly, it can sustain a fracture even under a comparatively small load. Taking a recent example, the derailment accident that occurred with the new rapid train ICE3 of Germany in 2008 was caused by the breakage of an axle. Fortunately, there were no casualties because the train was running at a low speed. However, in the wake of this accident, the methods of axle fatigue design began to be reviewed in Europe. In Japan, the breaking of an axle owing to fatigue has not occurred in many years. The reason for this is that the safety of axles has been secured by careful axle design, strict material control, and proper maintenance on the basis of many years of experience. For the railway people, the breaking of an axle is a major problem because it can lead to a serious accident. Therefore, each railway operator implements thoroughgoing axle maintenance, which is no small burden. Our company, too, has conducted research on axle fatigue, although on a modest scale, through durability tests, etc., by using full-scale axle models. The railway system components, including rails, are among the representative products that are subjected to repeated loads. Our company continues studying metallic fatigue with the aim of materializing fail-free railways that can be used safely and securely.

In this special issue of railways, the present technical problems and future outlook for railways are described for the railway products that the company manufactures. Several items about familiar railways have already been put into practical use. Their analysis in actual use will deepen your understanding of the railways. It is expected that the railway-related technology will become increasingly diversified. As mentioned earlier, the business integration has enabled our company to combine our railway-related technology with rolling stock technology. We intend to deepen the interchange between rail engineers and rolling stock engineers, and press ahead with our R&D on railways from a broader perspective, so that we can offer better products for railways. Please look forward to the future of our company.