Optimization of the Production Organization Pattern in Tangshan Iron and Steel Co., Ltd.

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Abstract: High-efficiency production organization should be simple and “laminar”. A one to one “laminar flow” operation mechanism is supposed to be accepted as a prerequisite to build high-efficiency clean steel “production platform”. Concerning the fact that establishing a one to one “laminar flow” production pattern is impossible at Tangshan Iron and Steel Co., Ltd., “quasi-laminar flow” production pattern was evaluated. Result shows that rolling bar products of various specifications have great impact on the liquid steel supply model between BOF and CC. Considering the process matching issue of steelmaking-continuous casting-rolling process in bar production line, a “quasi-laminar flow" production pattern between BOF and CC was proposed according to different rolling specification in bar mills. Through analysis and research on current production pattern, combined with principles and strategy for BOF workshop control, and taking the plant layout into account, “quasi-laminar flow” production pattern was finally established. Moreover, Gantt chart of “quasi-laminar flow" production pattern was drawn. It is shown that the relative “order degree” of the “quasi-laminar flow" production pattern rises, which is conductive to production scheduling and ladle operation turnaround in comparison with “turbulence” production pattern. While a careful evaluation should be conducted due to the fluctuant temperature drop caused by the inevitable inserted heats and decreased operation rate of inserted BOF before adapting the production pattern.

Key words: steelmaking-casting process; matching between converters and continuous casters; “quasi-laminar flow" production pattern; Gantt chart

The construction of high efficiency and low cost clean steel “production platform” is an important issue for China’s steel enterprises in recent years[1]. Building high-efficiency clean steel “production platform” requires a series of supporting technologies and integration technologies, and integration technologies consist of optimized-simplified process network technology and dynamic-orderly operating material flow technology[2]. This study aims at the required integration technologies for the construction of high-efficiency clean steel “production platform” in Tangshan Iron and Steel Co., Ltd., which mainly focuses on optimization issue of the production pattern in bar production line.

It’s a prerequisite to build an “orderly platform” before making an exhaustive study, which is also required to solve the system optimization issue of production pattern. Therefore, “machine matching” principle has become the theoretical basis for the optimization of production pattern[3]. However, due to the updated equipment and technologies in steel workshop, taking the dynamic updates into account, the matching degree between processes has become an important factor which greatly affects the system efficiency[4]. As a modern steel workshop, according to the “machine matching” principle, a “laminar flow” notion should be adapted, i.e. a top-down and one to one "laminar flow" operation mechanism should be established to avoid confusing machine matching relation[5].

1 Current Production Pattern in Bar Production Line

Current production process in Tangshan Iron and Steel Co., Ltd. consists of 4 converters, 2 refining furnaces, 5 casters and 5 rolling lines, thus the mass flow is complicated and production scheduling is difficult. In this study we were concerned with the process of BOF-CC No.5, 6-bar production line No.1, 2, which No. 5 caster is in correspondence with bar

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production line No.1, No.6 with bar production line No. 2. Fig. 1 shows the current production pattern of BOF-CC process in bar production line. Table 1 shows production rhythm of BOF and CC. Since the production rhythm between BOF and CC cannot be matched (see Table 1), the one-to-one "laminar flow" operation between BOF and CC cannot be achieved[6]. This is mainly attributed to the constant new technology adaption and equipment modification of Tangshan Iron and Steel Co., Ltd. Because of

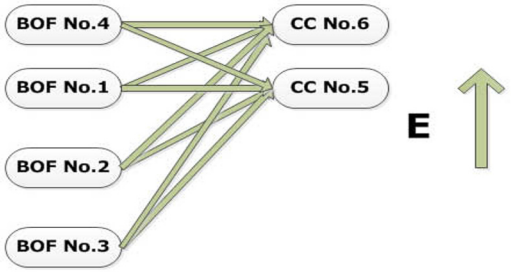

Fig. 1 Present production pattern of BOF-CC process in bar production line

Table 1 Production rhythm of BOF and CC

BOF No.	BOF No.1	BOF No.2	BOF No.3	BOF No.4	—
Heat of duration/min	24	23	24	25	—
CC No.	CC No.1	CC No.2	CC No.3	CC No.5	CC No.6
Casting time/min	30	28	25	18	20

engineering problem during production, the previous "machine matching" relationship is broken. Adapting new technology and new equipment causes the running rhythm between processes difficult to match and mass flow difficult to achieve balance.

Fig. 2 shows practical production scheduling Gantt chart of BOF-CC process in bar production line, where TT represents transporting time, WT waiting time. As Fig. 2 shows, the principal defect of the existing production pattern lies in two aspects: complex mass flow caused by the failure to establish "machine matching" between BOF and CC; longer waiting time to be casted for certain heats.

2 "Quasi-laminar Flow" Production Pattern

2.1 Establishment of "quasi-laminar flow" production pattern

The principal part of "quasi-laminar flow" production pattern is to ensure that the one to one "laminar flow" operation mechanism between a particular BOF and the specific CC is established. Compared with "laminar flow" pattern, the certain heat supplied by converter needs to be inserted to guarantee sequential casting.

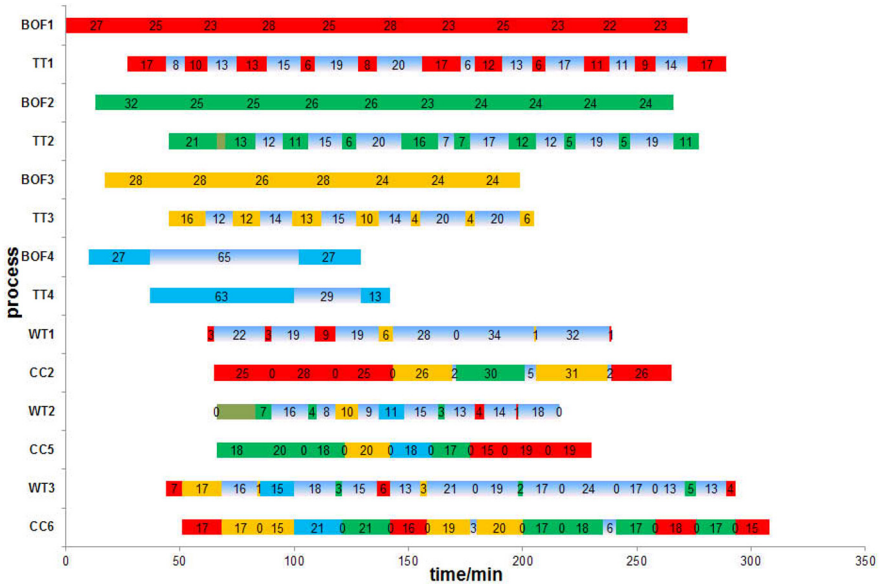

Fig. 2 Practical production scheduling Gantt chart of BOF-CC process in bar production line