

自動面圧負荷SV装置

Automatic Face Pressure Loading Slide Gate Valve Equipment

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Abstract

Shinagawa has developed new generation of slide gate valve equipment (SV equipment) called “SST” that reduces both the time necessary to exchange the plates and the number of component parts to lower costs. Face pressure loading and load release of the newly developed SV equipment are very simple. The SST type slide valve equipment is composed of about half the number of parts used in ordinary equipment.

1. はじめに

取鍋からタンディシュへ、又タンディシュからモールドへの溶鋼流量を制御するスライドバルブ装置（以下、SV装置）は、鋼の品質や生産性に影響する重要な装置である。SV装置は面圧を負荷されたスライドプレートに油圧又は電動シリンダーを用い摺動させることにより溶鋼の流量を制御するものである。取鍋用など大型のSV装置には大きな面圧負荷力を必要とし、人力で面圧負荷を行うトグル方式では、作業者の大きな負担となっている。近年、作業性向上を目的にシリンダーの推力を利用した自動面圧負荷方式が主流となりつつある。当社では、既に自動面圧負荷装置SAT型を実用化しているが、新たにSST型を開発したので以下に紹介する。

2. れんが交換作業の高効率化

Fig. 1 に示す様に、従来のトグル方式を採用するSQT型ではテコの原理を利用し人力で面圧負荷又は解除を行っていたが、自動面圧装置においては油圧シリンダーの推力を利用し面圧負荷解除を行う。プレート交換のため面圧解除をする際に、先に開発したSAT型ではSV装置全開位置にてノズル孔内を酸素洗浄した後、全閉位置までスライドプレートを移動させ、専用ピンを差し込み、更に全開にする必要があった¹⁾。

1. Introduction

Slide gate valve equipment (aka SV equipment) controls molten steel flow from ladle to tundish, or from tundish to mold. It is an important system because it influences steel quality and productivity. SV equipment controls molten steel flow by moving a slide plate that is face pressure loaded. In case of large size SV equipment for the ladle, ordinary SV equipment of the “toggle type” requires great effort for plate replacement because the face pressure is applied manually. Shinagawa has already developed automatic surface load SV equipment (“SAT” type) which the face pressure load is applied via an actuator. This type has become popular. Recently Shinagawa have developed an improved automatic face pressure loading type of SV equipment (“SST” type). This paper presents details of this new generation of SV equipment.

2. Higher Efficiency Plate Replacement

Ordinary SQT type SV equipment adapts the toggle method using leverage and requires manual effort to apply the face pressure load as shown in

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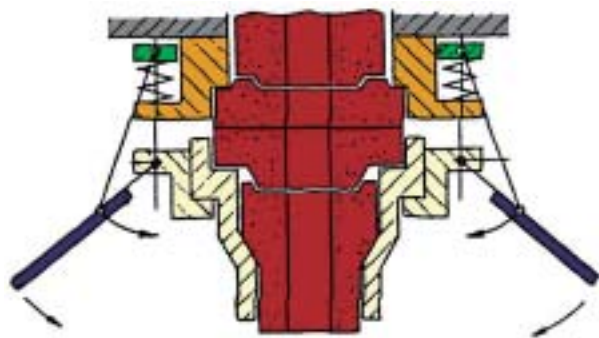


Fig. 1 Face pressure loading mechanism of SQT.



Fig. 2 Photograph of newly developed SV equipment "SST".

これに対し、新型のSSTでは酸素洗浄後、Fig. 2 に示すストッパーを手前に90°回転させ、スライドプレートを僅か数十mm程度下方へ移動させるだけで面圧解除並びに装置開放が可能となった。SATとSSTの作業工程比較をFig. 3 に示す。また、面圧負荷作業の省力化に加え、SAT及びSST型の自動面圧負荷装置では、トグル式のSQT型よりプレート形状を約10%程度小型化したため、れんが交換時の作業性は大きく改善された。当社SV装置の比較表をTable 1 に示す。

3. 部品点数の削減

今回開発したSSTのもう一つのメリットとして、部品点数の削減が挙げられる。SSTではFig. 4 に示す部品

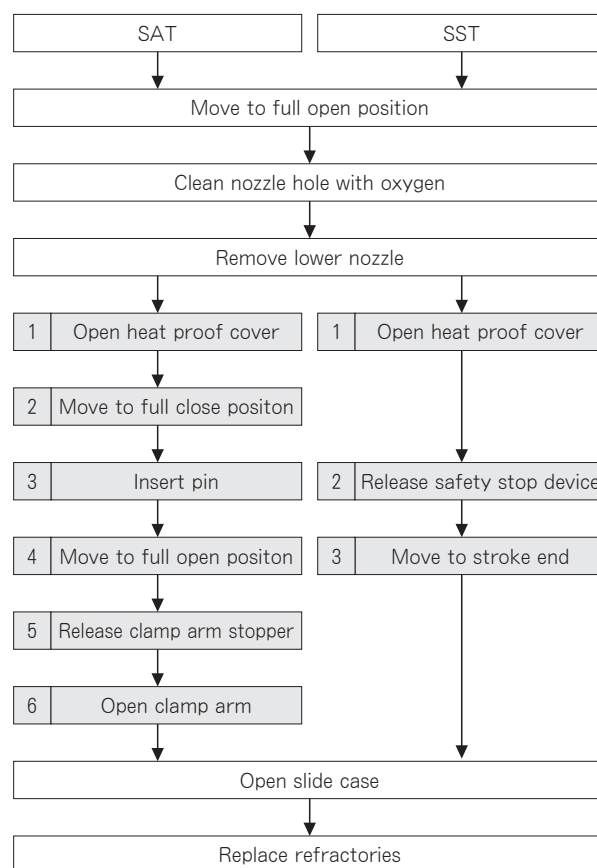


Fig. 3 Flowchart of the operating steps of SAT and SST.

Fig.1.

On the other hand automatic face pressure loading SV equipment applies the face pressure load by an actuator. In the case of the earlier developed "SAT" automatic face pressure loading SV equipment, when the face pressure is released to replace the plates, the operator has to move the slide plate to full close position after cleaning up the inside of nozzle hole with oxygen at full open position, then insert a pin, and move the slide plate to full open position again¹⁾. However, in the case of the latest model "SST", it is possible to release the face pressure by moving the slide plate only several tens mm after turning the safety stop device through an angle of ninety degrees (Fig.2). Fig.3 shows a flow-chart of the operating steps of the SAT and SST. In addition, with automatic face pressure loading SV equipment like the SAT and SST, plate replacement becomes less laborious because the plate sizes are

Table 1 Comparison of the characteristics of SV equipment for Ladle

Type of equipment	SQT	SAT	SST
	Ordinary	Improved	Latest modle
Method of face pressure loading Power source of loading	Toggle (Crowbar) Manual	Insert pin Actuator	Turn safety stopper ←
Standard bore size (mm) Stroke (mm)	50, 70, 80 150, 200, 240	← 130~150, 175, 210	← ←
Slide plate size (Index)	100	90	←
Number of parts (Index)	100	102	50

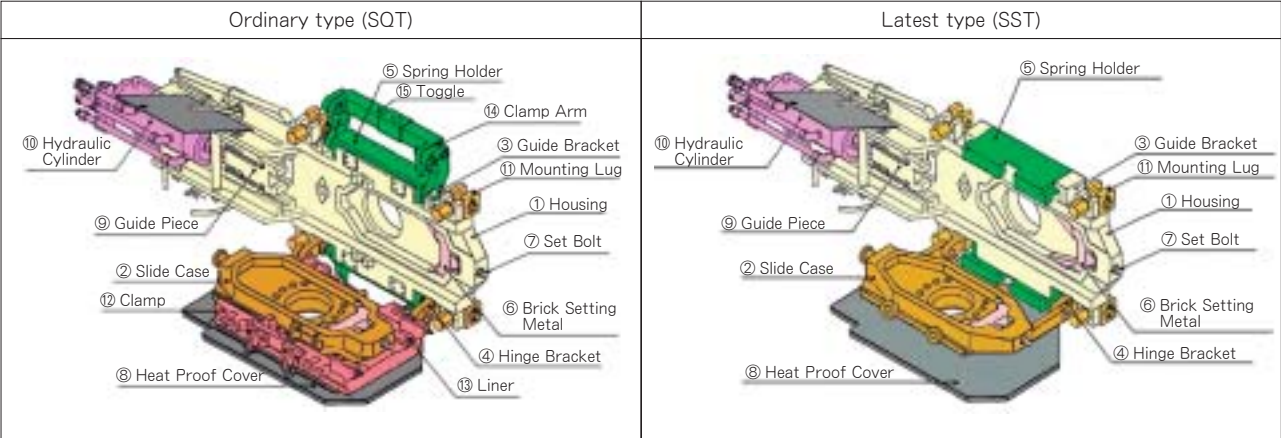


Fig. 4 Bird's-eye view of SV equipment.

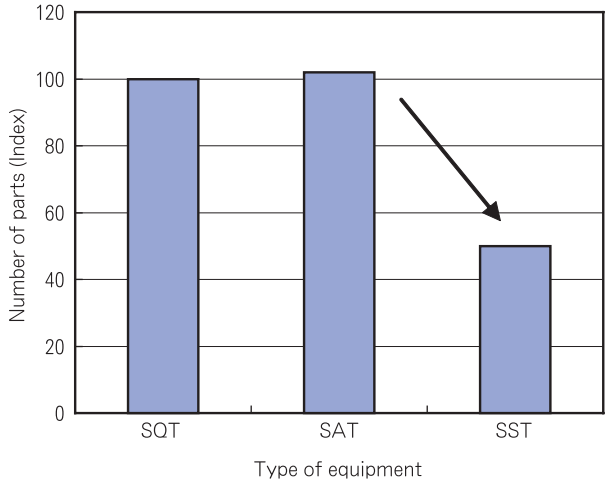


Fig. 5 Number of component parts.

⑤バネホルダー自体が部品②スライドケース保持の役割も果たすため、従来装置の主要部品であった部品⑫クランプ、⑬ライナー及び⑭クランプアームなどを取付ける必要がなくなった。その結果、SST型は部品点数を従来の約半分にまで削減できた (Fig. 5)。この部品点数の削減はSV装置自体の低コスト化だけでなく、メンテナンスコスト削減にも寄与する。

smaller than with the SQT type. Table 1 is a comparison of the characteristics of these three types of SV equipment for the ladle.

3. Reduction of Component Parts

Another advantage of SST is the reduction of component parts. Fig.4 shows a bird's-eye view of the SV equipment. In the case of SST, the main parts for ordinary SV equipment like clamp (part ⑫), liner (part ⑬),and clamp arms (part ⑭) were not necessary because the spring holder (part⑤) holds the slide case (part ②). As s result, we could reduce the component parts by half in comparison with ordinary SV equipment (Fig.5). Reduction of the number of component parts not only lowers the costs of SV equipment itself but also reduces maintenance costs.

4. Conclusion

Operation of the new SV equipment “SST” is

4. まとめ

今回開発した新型SV装置SSTは部品構成を大幅に変更し新たな面圧負荷方法を採用したことで、れんが交換時の作業性を大きく改善した。また、部品点数を従来の約半分にまで削減し低コスト化も実現した。本装置は既に実機使用されており、ユーザーからも好評価を得ている。

quite simple because of the design and the adoption of a new method for face pressure loading. In addition, Shinagawa could reduce the component parts to half that of ordinary SV equipment. The newly developed SST type SV equipment has been used in actual steel ladles and has received favorable reviews from some customers.

References

- 1) K. Mitsui and M. Osada ; Shinagawa Technical Report 47, 119, (2004)