

SPECIFICATION

Method for soaking treatment of cold steel billets and/or hot steel billets and apparatus for carrying out the said method

Background of the invention

The present invention relates to a method for soaking treatment of either of preheated cold steel billets held in storage in stockyard or the like an hot steel billets coming from the preceding blooming process or mixture thereof in dependance on the rolling schedules in the preceding and/or subsequent rolling processes without any intermittance of soaking operation. Further the present invention relates to an apparatus for carrying out the aforesaid method.

Particularly the present invention relates to a method and apparatus for soaking treatment at improved thermal efficiency and minimized oxide scale generated, comprizing in combination the steps of preheating the cold steel billets with the use of exhaust gas coming from the soaking pit which serves for soaking treatment as a preliminary treatment to the subsequent rolling process, transferring quickly the preheated cold steel billets to the inlet of the soaking pit, charging successively either of the preheated cold steel billets and hot steel billets or mixture thereof into the soaking pit one by one in dependance on the operation schedule of the preceding and/or subsequent rolling processes and delivering the steel billets to the subsequent rolling process after completion of soaking treatment.

As well known, hitherto known steel making furnaces such as convertor, open hearth furnace, electrical furnace etc. are operated in batch system. Correspondingly steel billets are intermittently produced in a blooming mill plant. On the other hand, since rolling process is carried out in continuous system, it is required that steel billets are always continuously supplied to rolling mill, which have been subjected to soaking treatment. In view of these facts as mentioned above, some surplus steel billets should be temporarily kept in storage. This results in heavy difficult in control operation of cooling, reheating and others, adverse effect on quality and yield rate of products and reduced production capability of continuous production. Further hitherto walking beam furnaces are used for soaking treatment, but it is pointed out as drawbacks with the conventional soaking treatment furnaces that large heating capacity is required, since the conventional furnace is designed such that steel billets are subjected to reheating after passing through cooling process and the furnace is provided with moving parts, resulting in increased running cost and reduced possibility of manpower saving.

Thus the present invention is intended to eliminate the drawbacks inherent to the hitherto known method and apparatus.

Object of the invention

A main object of the present invention is to provide a method and apparatus in which either of cold steel billets and hot steel billets or mixture

thereof are subjected to soaking treatment in dependance on operational conditions so that the steel billets are continuously delivered to the subsequent rolling process after completion of soaking operation.

Other object of the present invention is to provide a method and apparatus in which in spite of a fact that the preheating furnace is arranged separately from the soaking pit, the exhaust gas from the soaking pit is directly used as thermal energy source in the preheating furnace, resulting in improved thermal efficiency and reduced fuel unit cost.

Another object of the present invention is to provide a method and apparatus in which preheating is started and effected in the preheating furnace at lower temperature with cold steel billets and then soaking treatment is very quickly carried out for the steel billets charged into the soaking pit, resulting in reduced oxide scale generated thereon.

Further object of the present invention will be obvious from the following description and appended claims.

Summary of the invention

To accomplish the aforesaid objects there is provided in accordance with the present invention a method which comprizes substantially in combination the steps of preheating cold steel billets in a preheating furnace with the use of exhaust gas coming from a soaking pit which serves for soaking treatment as a preliminary treatment to the subsequent rolling process, the said preheating furnace being arranged separately from the soaking pit, delivering the preheated cold steel billets to the inlet of the soaking pit, during which step the said preheated cold steel billets being turned over by 180 degrees and/or delivering the hot steel billets to the inlet of the soaking pit, charging successively either of the said preheated cold steel billets and hot steel billets or mixture thereof into the soaking pit, allowing the steel billets to be subjected to soaking treatment in the soaking pit, while they are displaced in transfer grooves disposed in parallel to each other in the soaking pit, of which cross section is substantially upper enlarged trapezoid, and taking them to the subsequent rolling process from the outlet of the soaking pit. Further there is provided in accordance with the present invention an apparatus which comprizes substantially in combination a soaking pit in which thermal energy sources such as oil burners are located at the upper part of the furnace wall and transfer grooves having a substantially upper enlarged trapezoidal section are arranged on the hearth thereof in parallel to each other, a preheating furnace located by the side of the said soaking pit at a right angle to the same, a small flue between the both furnaces to communicate the side portion of the soaking pit with the upper portion of the preheating furnace, a first pusher for pushing a cold steel billet having a square section into the preheating furnace in a lateral posture, a second pusher located by the rear side of the preheating furnace for pushing out the preheated cold steel billet through a turn groove onto a transfer roller table which is arranged by the side of the soaking pit in parallel

thereto, the said preheated cold steel billet being turned by 90 degrees at the said turn groove located at the rear part of the preheated furnace, a third pusher located by the side of the inlet of the soaking pit for pushing the preheated cold steel billets held in a standstill onto the said transfer roller table to displace it to turn it by another 90 degrees at a turn step in the same direction as at the said turn groove, a supply roller table for supplying a hot steel billet having a square section coming from the preceding blooming process to dispose the same in juxtaposition with the said cold steel billets, a traverse transfer device for displacing laterally the said preheated cold steel billets and/or the said hot steel billets thereon to locate the same in position in front of the inlet of the soaking pit, the said position corresponding to that of the transfer groove in the soaking pit, a charging device for charging the said preheated cold steel billets and/or the said hot steel billets held in a standstill in position into the transfer grooves in the soaking pit in the longitudinal direction and a delivery roller table for delivering the steel billets to the subsequent rolling process after completion of soaking treatment in the soaking pit.

To minimize cooling of the preheated cold steel billets and hot steel billets, there is provided a control system whereby during traverse transfer of the said preheated cold billets and/or hot steel billets the charging device is retracted to the position prior to its operation, while during return movement of the traverse device to the position prior to its operation the charging device carries out its charging operation for the said cold steel billets and/or hot steel billets to be subjected to soaking treatment.

Brief explanation of the accompanying drawings

The present invention will be described in detail with reference to the accompanying drawings illustrating a preferred embodiment of the invention, in which

Figure 1 is a plan view illustrating a general arrangement of a soaking treatment installation in accordance with the present invention,

Figure 2 is a front view of the installation as shown in *Figure 1*, partially broken away,

Figure 3 is a sectional view of a continuation of a soaking pit and a small flue, taken in the longitudinal direction,

Figure 4 is a plan view illustrating a transfer roller table, a third pusher device, a supply roller table, a traverse transfer device and a charging device, each of which is located around the inlet of the soaking pit.

Figure 5 is a side view of the installation in *Figure 4*.

Figure 6 is a side view illustrating the third pusher device and the traverse transfer device,

Figure 7 is a side view of the charging device, and

Figure 8 is a plan view of the charging device in *Figure 7*.

Detailed description of the preferred embodiment

Now referring to the figures, the reference numeral 10 denotes a soaking pit in which a billet 1 is subjected to soaking treatment, the said soaking pit 10 being provided with a plurality of oil burners 11 as

heat source. Further the soaking pit 10 is provided with a furnace wall 12 and a hearth 13, both of which are lined with heatproof bricks in plural layers. On the furnace wall 12 there are provided burners 14 which are arranged in zigzag in the direction seen from inlet to outlet with the predetermined distance therebetween. The burners are opened on the upper portion thereof for piping connection. Further on the hearth 15 there are provided the predetermined numbers of transfer groove 15 in a substantially trapezoidal section which is upwardly diverged, the said transfer grooves being arranged in parallel to each other in the direction seen from inlet to outlet. In the installation as illustrated in the drawings there are provided six lines of transfer groove 15, but it should be of course understood that the present invention is not limited only to the aforesaid specific numbers of transfer groove and that numbers of transfer groove to be arranged should be determined in dependence on thermal capacity of the soaking pit 10, required time length for soaking treatment and others.

The hearth 13 is constructed such that the same is lined with heat resistant bricks which preferably are mostly electrically molten murrine bricks such as Colhearth Black brick, the transfer grooves 15 have at its bottom a width not less than that of the billet 1 to be subjected to soaking treatment and the billets 1 moving within the transfer grooves 15 are subjected at this upper and both sides surfaces exclusive the moving bottom thereof to sufficient radiation and hot bathing in the soaking pit 10 so that the billets 1 are heated therein to a temperature of 1,100 to 1,200°C.

On the left side of the soaking pit 10 there is provided a preheating furnace 20 for preheating cold billets 1A coming from the stock yard or the like, arranged at a right angle to the soaking pit 10. The said preheating furnace 20 is connected to the soaking pit 10 through the small flue 16 so that the exhaust gas from the soaking pit 10 is blown into the preheating furnace 20 by way of the said small flue 16. The said small flue 16 is located on the furnace wall 12 in place in the midst of the billet passage in the soaking pit 20 so as to be in communication with the rear portion of the preheating furnace 20. As seen well from the plan view, they are arranged in a substantially T-form, but they may be arranged in another form such as L-shape, as required. Obviously the arrangement of the both furnaces 10 and 20 with their axes at a right angle one to the other is intended for simplification of the transfer line in such a manner that the cold billets 1A are moved laterally or longitudinally without any rotation thereof on a specific plane. Namely the arrangement is such that the cold billets 1A are moved through i.e. along the axis of, the preheating furnace 20 in a lateral posture, pushed out at the rear portion of the preheating furnace 20 in the longitudinal direction of the steel billets, displaced to a traverse transfer device and then transferred laterally thereon and finally charged in the soaking pit 10 in a longitudinal posture parallel to the axis of the pit. Owing to the arrangement of the soaking pit 10 and the preheating furnace 20 in the substantial T-form, as mentioned above exhaust gas is blown into the

preheating furnace 20 from the soaking pit 10 in the highest thermal efficiency.

The furnace wall 21 and the hearth 22 of the said preheating furnace 20 are also lined with heat resistant bricks in the same manner as those that in the said soaking pit 10, the said hearth 22 being provided thereon with several lines of transfer rail 23 having a square section, each of which extends parallel to each other. Further in order to increase in preheating capacity for the cold billets 1A in the preheating surface 20, there are provided the required numbers of burner opening 24 on the upper part of the furnace wall 21, in which oil burners can be incorporated for the purpose of additional combustion. Thus even in the case that the installation has to be operated only with cold steel billets 1A, the preheating capacity of the preheating furnace 20 can be increased to any extent, as required.

Since the preheating furnace 20 is communicated with the soaking pit 10 through the small flue 16, the exhaust gas in the soaking pit 10 flows into the preheating furnace 20 via the said small flue 16. Particularly the preheating furnace 20 is constructed such that the exhaust gas flows from the rear part of the preheating furnace 20 toward the front part thereof and leads to the ground flue 3 supported by the framework 2 by the side of the preheating furnace 20 via the underground flue 1 located at the front part of the preheating furnace 20 and then is discharged in the air through the large chimney 4 which is located in place by the side of the soaking pit 10. It is to be noted that an air preheater 5 and a compressor 6 are arranged in the underground flue 1 so as to recover thermal energy involved in the exhaust gas flowing through the said underground flue 1 and hot air under pressure is delivered to the heat source 11 via the blower piping 7 extending along the soaking pit 10. In Figure 1 the reference numeral 29 denotes a compressor which is located in place by the side of the preheating furnace 20 to supply pressurized air the oil burners which serve for additional combustion in the preheating furnace 20, while the reference numeral 8 denotes a transfer roller table at the outlet of the soaking pit 10, which serves to guide the steel billets into the predetermined position for the subsequent rolling process (not shown) with the aid of a swinging guide rod 9 after completion of soaking treatment in the soaking pit 10.

At the inlet of the preheating furnace 20 there is disposed a delivering table 25 on which cold steel billets 1A are unloaded by means of a crane 26, coming from the stock yard where they have been temporarily kept in storage. It is to be noted that the cold steel billets 1A are placed such that they are orientated at a right angle to the direction of their movement through the preheating furnace 20. As the cold billet 1A is lowered onto the delivering table 25, the first pusher 30 located behind the same is activated to force the billet into the preheating furnace 20 so that it is moved toward the rear part of the preheating furnace 20, sliding on the said transfer rails 23. While the cold billets 1A are moved forward at the same height as that of the transfer rails 23 spaced from the hearth bottom as they are

held on the said transfer rails 23 in the lateral posture, they are subjected to preheating over the whole faces thereof to a temperature of 800 to 950°C in the preheating furnace 20.

At the rear part of the preheating furnace 20 there is provided a turn groove 28 with an opening 27 arranged on the furnace wall 21, the said groove 28 extending at a right angle to the movement of the cold billets 1A, that is, extending in the same direction as the movement of the billets 1 through the soaking pit 10. The groove 28 is recessed adjacent to the rear end of the hearth 22 so that the preheated cold billet 1A is rotated by 90 degrees over the said groove 28 and falls therein. When the billet is rotated by 90 degrees and falls in the turn groove, the plane which was located at the bottom thereof during the movement over the transfer rails 23 comes to face against the inner side wall of the turn groove 28 on the side toward the front part of the preheater furnace 20.

Further there is provided a second pusher device 40 by the side of the rear part of the preheating furnace 20, which is adapted to be operated forward and backward in the longitudinal direction of the turn groove 28 through the furnace wall 21. The said second pusher device 40 is mounted parallel to the soaking pit 10 at the outlet side thereof in such a manner that water cooled pusher head 41 pushes the preheated cold billet 1A in the turn groove 28 through the opening 27 into the outside of the preheating furnace 20 by displacing hydraulically the said pusher head 41 from and into the cylinder 42. On the opposite side to the said second pusher 40 and on the side of the rear portion of the preheating furnace 20 there is arranged a transfer roller table 44 to be driven by a motor 43, the said transfer roller table 44 extending to the inlet of the soaking pit 10 along the soaking pit 10. When the second pusher 40 is operated forward and the preheated cold billet 1A in the turn groove 28 is forced out of the preheating furnace 20 to be placed on the transfer roller table 44, the preheated cold billet 1A is ready to be transferred on the transfer roller table 44 driven by the motor 43.

In the vicinity of the inlet of the soaking pit 10 there are arranged a third pusher 50, a supply roller table 60, a traverse transfer device 70 and a charging device 80, wherein the said third pusher 50 is located at the rear part of the transfer roller table 44 where the preheated cold billet 1A comes to stop so that the billet is slid thereon in the same lateral posture as it has arrived and then is turned by 90 degrees at a turn step, the said supply roller table 60 is arranged such that hot steel billets 1B are carried thereon from the preceding blooming process (not shown), the said traverse transfer device 70 serves to displace the preheated cold billet 1A or the hot billet 1B to the inlet of the soaking pit 10 in alignment with the transfer grooves 15 in the soaking pit 10, and the said charging device 80 serves to charge the steel billets 1A and or 1B into the soaking pit 10.

It will be added that a stopper 45 is secured to the transfer roller table 44 at the rear end thereof so that the preheated cold billet 1A comes in collision against the said stopper 45.

The rear portion of the said transfer roller table 44 is disposed parallel to the soaking pit 10 by the side of the inlet thereof and in addition to the said transfer table 44 another roller table, that is, supply roller table 60 is arranged in parallel to the rear part of the transfer roller table 44 by the side of the soaking pit 10 so that the hot billets IB coming directly or indirectly from the blooming process (not shown) are carried thereon and come to stop with the aid of the stopper 61 mounted securely to the rear end thereof.

Further the third pusher 50 located by the rear side of the transfer roller table 44 is provided with a reciprocating rod 51 which is driven by means of hydraulic unit. Further there is provided a slide stand 52 adjacent to the rear part of the transfer roller table 44, which comprizes several pieces of rail arranged at a right angle to the said transfer roller table 44 at the same height as that of the latter. As the rod 51 is moved forward, the preheated cold billet IA is displaced in the same lateral posture as it had, sliding on the said slide stand 52 and then is turned by another 90 degrees at a turn step 53 which is provided at the rear end of the sliding stand 52. Since the preheated cold billet IA is first turned by 90 degrees at said turn groove 28 and then turned by another 90 degrees at said turn step 53, as mentioned above, it has been turned over by 180 degrees with the result that the bottom surface of the billet in the preheating furnace becomes an upper surface after completion of the last mentioned turn. As seen well from Figure 3, the said turn step 53 is provided in a simple manner by way of height difference between the slide stand 53 and a transfer 71 which will be described later.

A traverse transfer device 70 is disposed on the extension of the rod 51 of the third pusher 50, that is, at the inlet of the soaking pit 10. This traverse transfer device 70 is constructed of a transfer stand 71 comprizing a plurality of skid rails in parallel to each other at a right angle to the direction of the movement of billets I into the soaking pit 10 and a plurality of chain transfers 74 with inclinable engagement paul 73 secured thereto to be driven forward or backward by power source 72 such as motor, the said engagement paul 73 being adapted to come up above or down below the transfer stand 71, so that the traverse transfer device 70 is directly or indirectly connected to the transfer roller table 44 via the said turn step 53, while it is flush with the upper surface of the supply roller table 60.

The transfer stand 71 is in direct continuation with the upper surface of the transfer roller table 44 via the turn step 53, in case that the third pusher 50 is not provided with the slide stand 52, but when the slide stand 52 is mounted, as illustrated in the figures, it is in indirect continuation with the upper surface of the transfer roller table 44, wherein the rear part of the slide stand 52 represents the front part of the transfer stand 71. The rear part of the transfer stand 71 is extended at the least to the position corresponding to the most far transfer groove 15 in the soaking pit 10, till it is crossed with the said supply roller table 60. In the meantime the chain transfer 74 is spanned, supported and guided

with the aid of sprocket wheels, tension gears or the likes so that the preheated cold billet IA or hot billet IB to be soak-treated may be displaced over the transfer stand 71 from the front part to the rear part thereof to occupy any position corresponding to a specific transfer groove 15 in the soaking pit. In order that the preheated cold billets IA or hot billets IB are transversely transferred one by one to the predetermined position at the inlet of the soaking pit 10, a manual or automatic control device is provided to determine the stop position of the traverse displacement.

The engagement pawl 73 of the chain transfer 74 is interposed between two chain blocks and fastened thereto, whereas the said engagement pawl is constructed of a insert casing 75 fastened to the chain blocks and an engagement piece 76 in a substantial triangular shape pivotted on the said insert casing 75, the said engagement piece 76 being adapted to stand vertically, when the chain transfer 74 is moved to its rear end on the transfer stand 71 (rotated and circulated in the anticlock direction in Figure 5 and 6), while the same be inclined down in the forward direction, when the said chain transfer 74 is moved reversely. Particularly the engagement piece 76 is adapted to stand vertically during the normal movement of the chain transfer 74 so that the same comes in engagement against side wall of the preheated cold billet IA or hot billet IB for its traverse movement, but when moving in the reverse direction, it disappears below the transfer stand 71, as it is rotated and inclined down in the forward direction due to its engagement against any obstacle located at a right angle to the transfer stand 71, such as other preheated cold billet IA, hot billet IB or a pusher head 84 of the charging device 80 which will be described later. The engagement piece 76 is designed so as to restore automatically to the vertical standing position by virtue of difference in rotation moment in the both directions about the pivotal axis. Besides this the engagement piece 76 may be operated by means of mechanical means such as spring, lever etc. Alternatively it may be actuated with the aid of hydraulic or pneumatical device which is adapted to operate through an operating hole provided in the insert block 75.

As illustrated in the figures, the chain transfer 74 is constructed with three lines parallel to each other, but it may be constructed with four or more lines. Further it is also possible to design the chain transfer in a single line, provided that preheated cold billet IA or hot billet IB is transferred laterally in the same posture as it had without any rotation thereof on the plane of the traverse movement. It will be the most preferable that the traverse transfer device 70 has a width as wide as possible so as to accomodate any considerable difference in length of preheated cold billet IA and hot billet IB.

In the embodiment as illustrated in the figures, the supply roller table 60 and the transfer stand 71 are arranged at a right angle one to the other at the same plane height. The arrangement as mentioned above is intended for a possibility that either or both of the preheated cold billet IA on the transfer roller table 44 and the hot billet IB on the supply roller table is or

are laterally transferred by single operation with the aid of the same transfer device 70, and moreover is intended for simple construction thereof. Of course the transfer roller table 44, the supply roller table 60, the traverse transfer device 70 and the others may be arranged in any way without any limitation only to the illustrated embodiment and their layout may be modified, as required.

The preheated cold billet 1A or the hot billet 1B which is held at the predetermined position on the transfer stand 71 is charged into the soaking pit 10 by way of pushing operation with the aid of self-propelled charging device 80 which is adapted to move in the longitudinal direction of the billets. For this charging operation the charging device 80 is constructed of a rail stand 81 arranged at the inlet of the soaking pit 10 in the direction of the movement of billets into the soaking pit 10, of which upper surface is located above the said traverse transfer device 70, a waggon 82 mounted freely movable on the said rail stand 81, several pieces of pusher head 84 inclinably mounted at the front part of the said waggon 82, raising and lowering mechanism 85 such as pneumatic cylinder which serves to incline up and down the pusher heads 84, and a driving mechanism 86 such as hydraulic motor carried on the waggon 82 to allow the waggon itself to move forward and backward.

The rail stand 81 is constructed such that a pair of rail 87 having a substantially H-section are supported on several pieces of column 88 at certain distance therebetween at the inlet of the soaking pit 10, the said rail 87 being arranged at a right angle to the transfer stand 71 of the traverse transfer device 70 and located above the said transfer stand 71, wherein the inner distance between the rails 87 is by no means narrower than the width of the soaking pit 10, particularly not less than the total inner distance of the parallel transfer grooves 15. In the meanwhile the height of the rail 87 is predetermined such that when the pusher heads 84 mounted inclinably on the waggon 82 travelling on the rail stand 81 are lowered, the top end of the pusher head comes in engagement against the preheated cold billet 1A or the hot billet 1B at the end portion thereof, and as the waggon 82 is moved forward, the preheated cold billet 1A and/or hot billet 1B are slid, when the pusher heads 84 raised, it becomes located above the transferred cold and hot billets 1A, 1B.

The waggon 82 is constructed by assembling a plurality of steel materials such as steel section in a form of lattice and held securely on the rail stand 81 by way of inserting support blocks 89 at four corners into the groove space on the inner side of the said rail 87.

The numbers of pusher 84 is six in the illustrated embodiment and this is because the numbers of transfer groove 15 arranged parallel to each other in the soaking pit 10 is six, wherein the extending direction of the respective pushers 84 conforms to those of the said transfer grooves 15. Figure 7 illustrates a typical example of the pusher 84 which comprizes a root part 92, of which upper portion is fastened to the swing shaft 83 pivotted on the waggon 82 at its front, and a charging part 92 which

is adapted to abut against the preheated cold billet 1A and/or hot billet 1B at its top end, the said both parts being integrally shaped in a substantially L-form seen from the side. As shown in the figure, the root part 91 has a cutout at approximate 45 degrees at the lower portion thereof, that is, at the rear portion of the charging part 91. This is intended for enabling the preheated cold billet 1A and/or hot billet 1B to pass freely beneath the pusher head 84, when the latter is inclined upward. Owing to the provision of the aforesaid cutout, it becomes possible to reduce the height of the rail stand 81 and the scope of the upward inclination of the pusher 84 itself as much as possible. As seen from the figure, the reference numeral 92 denotes a stopper plate extending vertically at the front of the waggon 82, which serves to support the reaction force which is caused as the lowered pusher head 84 forces the preheated cold billet 1A and/or hot billet 1B into the soaking pit 10 and moreover to prevent the pusher 84 from being further inclined downward.

It should be of course understood that the shape of the pusher head 84 is not limited only to the illustration in Figure 7 and it may be any one, for instance, triangle seen from the side or rod-like shape which extends down obliquely, provided that it can stand satisfactorily the load which is caused when the preheated cold billet 1A or hot billet 1B is charged with the pusher head 84 lowered down and that there is provided enough wide space below the pusher head which is raised up.

The raising and lowering mechanism 85 is fastened to the front portion of the waggon 82, which carries out raising and lowering the pusher heads 84. In the embodiment as illustrated in Figure 7 a pneumatic cylinder unit is employed, which is constructed such that a pair of support member 93 stand facing each other substantially at the center of the front portion of the waggon 82 and a cylinder 94 is swingably mounted midst the said pair of support member 93, from which a rod 95 is adapted to extend and retract and the extreme end of the said rod 95 is pivotally connected to the joint plate 96 fastened to the swing shaft 83. The said raising and lowering mechanism is operated in relation to the forward and backward movement of the waggon 82. Particularly as the waggon 82 is moved forward the soaking pit 10, the said rod 96 of the raising and lowering mechanism 85 extends out to rotate the swing shaft 83 to some extent via the joint plate 96, so that the pusher heads 84 are lowered down to come in engagement with the preheated cold billets 1A and/or hot billets 1B at the extreme end thereof and then they are moved forward. On the contrary, when the waggon 82 is moved off the soaking pit 10, the rod 95 is retracted so as to raise up the pusher heads 84.

As illustrated in Figure 8, several pieces of pusher head 84 are fastened to the single swing shaft 83 pivotally supported at the front portion of the waggon 82, and all of the said pusher heads 84 are raised up or lowered down by means of the swing shaft 83 which is rotated with the aid of the single raising and lowering mechanism 85 located at the front center of the waggon 82. Further it is ensured

that the preheated cold billets IA and/or the hot billets IB laterally transferred on the transfer stand 71 are moved without any complicated control for selecting a specific pusher head 84 corresponding to the said billet which has been stopped at the predetermined position. This arrangement as mentioned above will contribute successfully to simplified construction, easy inspection and maintenance and the others.

Thus the preheated cold billets IA and/or the hot billets IB are moved in sliding and charged into the soaking pit 10 with the aid of the pusher heads 84 lowered down as the waggon 82 is moved forward. It is to be noted that there is not provided any means for displacing billets in the soaking pit 10 because of the considerably high temperature prevailing in the soaking pit 10 and that the billets are taken out by pushing the whole trains of billets arranged in the transfer grooves 15 in parallel to each other from the inlet to the outlet thereof, the train being formed by a series of billet charged into the soaking pit one after another. Accordingly the waggon 82 should have pushing force much more than the force required for displacing only single preheated billet IA or hot billet IB. Namely the waggon 82 should have pushing force enough to displace the whole train of billets located longitudinally in the transfer groove 15 one after another from the inlet to the outlet thereof and to take one billet out of the outlet of the soaking pit 15.

Particularly the waggon 82 should avoid such undesirable behaviours as idle rotation, slippage, temporary stoppage due to the heavy reaction from billets 1, as the waggon 82 is moved forward. For this reason it is preferable to employ hydraulic motor as power source for the driving mechanism 86 of the waggon 82. The said driving mechanism 86 comprises substantially a hydraulic unit 97, a pair of hydraulic motor 98 arranged on the both sides of the waggon 82, wheels 99 located on the rail stand 81 and a driving shaft 100 pivotally supported on the waggon 82 to be rotated by the motor through the chain transmission. The said wheel 99 has gear tooth on the periphery thereof, which comes in engagement with the rack means 101 mounted of the rail 87 of the rail stand 81 so that it is ensured that the travelling and driving force from the hydraulic motor 98 enables the waggon 82 to be moved against the reaction from the billets 1.

Hence the charging device 80 and the traverse transfer device 70 should be controlled in such a manner that the charging device 80 starts to be moved forward only after the preheated cold billets IA and/or hot billets IB are laterally transferred by means of the traverse transfer device 70. Further in order to prevent the preheated cold billets IA and/or the hot billets IB from being cooled prior to entering the soaking pit 10, it should be taken in consideration that they are charged into the soaking pit 10 within possibly short time after completion of the traverse transfer thereof.

To this end it is preferable that a control cycle is provided in such a manner that the charging device 80 is retracted to the original position prior to operation thereof during the traverse transfer of the

preheated cold billets IA and/or hot billets IB to the inlet of the soaking pit 15 by means of the traverse transfer device 70, while the charging device 80 carries out its charging operation for the preheated billets IA and/or hot billets IB to be charged into the soaking pit 15 during the return movement of the traverse transfer device 70 to the original position prior to its operation.

Particularly the control cycle is constructed such that as the charging device 80 is retracted, the pusher head 84 is raised up to keep an open space below the said pusher heads 84, through which the preheated cold billets IA and/or hot billets IB can be freely transferred in the lateral direction, so that the preheated billets IA and/or hot billets IB are laterally transferred to the predetermined position on the transfer stand 71 at the inlet of the soaking pit 10 during the return movement of the charging device 80, that as the charging device 80 is moved forward, the traverse transfer device 70 is returned to the position before its operation in the opposite direction without any hindrance, because the inclinable transfer pawl 73 of the chain transfer 72 is inclined and lowered down, when coming in contact with the hot billet IB which is supplied on the supply roller table 60, and that the return movement of the traverse transfer device 70 during the forward movement of the charging device 80 and the normal transfer of the traverse transfer device 70 during the return movement of the charging device 80 are effected at the same time.

Incidentally, the reference numeral 110 in the figures denotes a pass line located on the opposite side to the third pusher 50 adjacent to the inlet of the soaking pit 10, of which upper plane is flush with the upper surface of the transfer stand 71 of the traverse transfer device 70. The said pass line 110 serves to keep temporarily the preheated cold billets IA and/or hot billets IB thereon, the said billets being those that are passed by the inlet of the soaking pit 10 because of some temporary shutdown of rolling operation, which is caused by some trouble in the rolling process, so that preheating and blooming operation may continue to be carried out.

Now soaking treatment operation in accordance with the present invention will be described in detail for cold billets IA which has been kept temporarily in stock yard or the like as well as hot billets IB coming directly from the preceding blooming process without remarkable cooling thereof.

The cold billets IA is first placed on the charging stand 25 at the inlet of the preheating furnace 20 with the aid of the crane 26 or the like in a right angle to the longitudinal axis of the preheating furnace 20, and then is charged into the preheating furnace 20 by means of the first pusher 30. During movement through the furnace, the cold billet IA is preheated to a temperature of approximately 800 to 950°C subject to the exhaust gas which flows thereinto through the small flue 16 from the soaking pit 10 in which thermal energy source 11 is provided. Coming close to the rear part of the preheating furnace 20, the preheated cold billet IA is rotated by 90 degrees and falls at the turn groove 28 therein. Then the preheated cold billet IA is pushed out on the transfer roller

table 44 from the said turn groove 28 through the opening 27, the said transfer roller table 44 being located alongside the soaking pit 10. Next the preheated cold billet 1A is transferred over the said transfer roller table 44 and comes to stop at the stopper 45 at the rear end of the transfer roller table 44. Then the third pusher 50 is activated to slide laterally the preheated cold billet 1A from the transfer roller table 44 onto the slide stand 52. Coming to the turn step 53, the preheated cold billet 1A is rotated further by 90 degrees in the same manner and direction as at the said turn groove 28 and falls on the transfer stand 71 of the traverse transfer device 70. On the other hand, the hot billet 1B coming from the blooming process which is another operation line different from that of the said cold billets 1A is travelling on the supply roller table 60 located in parallel to the said transfer roller table 44 and comes to stop at the stopper 61 at the end portion of the said supply roller table 60 in juxtaposition with the preheated cold billets 1A. Since the supply roller table 60 and the transfer stand 71 are at the same level, the both preheated cold billets 1A and hot billets 1B are gathered together thereon.

Next, as the traverse transfer device 70 is activated, either of the preheated cold billet 1A or the hot billet 1B is displaced to the predetermined position in front of the inlet of the soaking pit 10 with the aid of the inclinable engagement pawl 73 of the chain transfer 74, sliding on the transfer stand 71 in the lateral posture. The said billet 1A or 1B comes stop at the said position corresponding exactly to the transfer grooves 15 which are arranged in parallel to each other in the soaking pit 15. It is to be noted that either the preheated billet 1A or the hot billet 1B is laterally transferred one by one in such a quick manner as to reduce substantially natural cooling during movement thereof on the transfer stand 71.

Now the charging device 80 starts to move forward with the pusher heads 84 mounted thereon, which is held in the lowered state. The top end of the pusher heads 84 comes in engagement with the end face of the preheated cold billets 1A or the hot billets 1B and brings them into the soaking pit 10. After completion of charging operation, the charging device 80 is retracted with the pusher head 84 held in the raised state so that the said charging device 80 is ready for next charging operation on the rail stand 81. In the meantime the chain transfer 74 starts again to displace laterally to the inlet of the soaking pit 10, the said chain transfer 74 being moved back to the original position during the forward movement of the charging device 80. By repeating the aforesaid operations the preheated cold billets 1A and hot billets 1B are charged continuously into the soaking pit 10 one after another.

Charging order may be such that, for instance, a billet is charged in the transfer groove 15 one by one in order of the right to left side thereof and this order of charging operation is repeated. The soaking-treated billet 1 is taken out on the delivery roller table 8 arranged at the outlet of the soaking pit 10 by means of rear end billet in the transfer groove 15 which has been just charged into the soaking pit.

Each billets 1 is subjected to soaking treatment at a

temperature of 1,100 to 1,200°C with the aid of thermal energy source 11 such as oil burner, while it is charged into and taken out from the transfer groove 15 one by one in accordance with the specified order, so that it may stay in the soaking pit 10 as long as possible so as to ensure the required quality of soaking treatment.

As mentioned above, when installing the soaking pit in accordance with the present invention, it is possible to utilize satisfactorily the residual thermal energy involved in the exhaust gas from the soaking pit 10 in the preheating furnace 20, because the soaking installation is constructed such that the exhaust gas in the soaking pit 10 is adapted to flow into the preheating furnace 20 through the small flue 16 and preheat cold billets 1A therein. It is to be added that as known well, the soaking pit 15 serves to soaking treatment as a preliminary process before hot rolling.

After preheating in the preheating furnace 20, the cold billet 1A is rotated by 90 degrees at the turn groove 28 at the rear part of the preheating furnace 20 and moreover is rotated again by another 90 degrees at the turn step 53 in the same direction as at the said turn groove 28 on the way to the transfer stand 71 of the traverse transfer device 71 from the transfer roller table. This means that the cold billet 1A is turned over by 180 degrees so that the lower side thereof on the hearth 22 of the preheating furnace 20 becomes an upper side in the soaking pit 10. As a result the cold billet 1A is uniformly heated with reduced oxide scale on the surface thereof during preheating in the preheating furnace 20 as well soaking treatment in the soaking pit 10. It is to be added that the upper enlarged trapezoidal section of the transfer groove 15 contributes remarkably to prevention of irregular heating over the cold billet 1A.

Since the transfer groove 15 arranged in parallel to each other in the soaking pit 10 has an upper enlarged trapezoidal section, it has better efficiency in thermal conductivity by way of radiation than that of the conventional square section, that is, it absorbs more thermal energy of radiation heat. In view of a fact that the steel billet 1 has a square section, while the transfer groove 15 has a trapezoidal one, there exists improved thermal angular relation therebetween so that the steel billet 1 is subjected to thermal bathing by way of radiant heat from the both inclined walls of the transfer groove 15, direct radiant conduction from the heat source 11 onto the upper surface of the billet and conduction heat from the hearth 13 to the bottom of the billet. This results in reduced time length of soaking treatment, minimized oxide scale, stable quality and high yield rate of rolling products.

As mentioned above, the preheated cold billets 1A from the preheating furnace 20 and the hot billets 1B from the blooming process are gathered together in front of the inlet of the soaking pit 10 to be charged thereinto. The present invention is not limited only to this arrangement. Only either of the preheated cold billets 1A and hot billets 1B may be charged into the soaking pit 10 in dependence on the scheduled operation. Alternatively any of both billets 1A and 1B may be used. The installation and arrangement in

accordance with the present invention therefore can adapt to any variation and modification to continue supply of steel billets 1 to the subsequent rolling process, keep the rolling process in continuous operation and reduce substantially running cost.

In addition a fact that the both soaking pit 10 and preheating furnace 20 are connected by way of the small flue 16, causing the exhaust gas from the soaking pit 10 to be utilized as thermal energy source for the preheating furnace, even though the said two furnaces 10 and 20 are separately build and another fact that there is provided no cooling means for the preheated cold billets 1A and the hot billets 1B at any rate will contribute to considerably increased thermal efficiency and reduced fuel unit cost.

Further since the temperature distribution through the preheating furnace 20 ranges from the considerable high temperature at the rear part of the preheating furnace 20, in which the exhaust gas is blown from the soaking pit 10, to the room temperature at the inlet thereof in the lower thermal level, preheating for the cold billets 1A in the preheating furnace 20 is effected such that it starts in lower temperature at the inlet thereof and thereafter temperature is increased gradually. Moreover a fact that the preheated cold billets 1A are rotated by 180 degrees on the way to the soaking pit 10 will ensure uniform heating in the soaking pit as well as very few oxide scale generated thereover.

Further another fact that the hot billets 1B are added to the soaking treatment in the soaking pit 10 will contribute to reduced thermal capacity of the thermal energy source 11 and remarkably reduced time length of soaking treatment, resulting in lowered thermal energy unit cost in the whole running cost, because the latent heat in the hot steel billet 1B itself can be advantageously utilized. Since fuel consumption at the thermal energy source 11 is substantially reduced in that way, total generation of Nox, Sox or the like will be minimized. This will contribute to prevention of public pollution, resulting in reduced preventive cost against pollution problems.

Another advantages with the arrangement and installation in accordance with the present invention are that each of the said devices 30, 40, 50, 60, 70, and 80 and the associated components are designed and constructed in a simple way and a series of operation is smoothly effected, since the preheating furnace is arranged in a right angle to the soaking pit 10, the transfer roller table 44 is arranged in parallel to the soaking pit 10, billets are laterally transferred with the aid of the third pusher 50 and the traverse transfer device 70 and billets are charged in the longitudinal direction with the aid of the charging device 80 so that billets are transferred in the predetermined direction from the inlet of the preheating furnace 20 into the soaking pit 10 by way of repeated lateral and longitudinal transfer movements without any plane rotation and any specific control for orientation of billet.

Moreover owing to a fact that each of the said devices 30, 40, 50, 60, 70, 80 and others is smoothly operated, the cold billets 1A and hot billets 1B are adapted to slide on the hearth 13 and 22 in the both

of soaking pit 10 and the preheating furnace 20 without any arrangement of movable device on the hearth as seen in the conventional walking beam, and any water cooling device and driving device as associated device are not required therefor, the installation and arrangement in accordance with the present invention can be simplified, be built at less initial construction cost and be operated at remarkably reduced running cost.

As mentioned above, characteristic features of the present invention lie in that either of cold billets in stockyard or the like and hot billets coming from blooming process or mixture of the same are successively subjected to soaking treatment and then continuously delivered to rolling process in good balance between rolling operation and soaking treatment and/or blooming process and soaking treatment, resulting in improved productivity and that preheating is carried out with the aid of exhaust gas which comes from the soaking pit after completion of soaking treatment, resulting in effective and improved usage of thermal energy involved in the exhaust gas, reduced running cost, minimized oxide scale and so forth.

As obvious from the above description of the preferred embodiment, it should be of course understood that the present invention may be modified and changed by any expert of the art without any departure from the spirit of the invention.

CLAIMS

1. A method for soaking treatment of cold steel billets and/or hot steel billets comprising in combination the steps of preheating the cold steel billets in a preheating furnace with the use of exhaust gas coming from a soaking pit, the said preheating furnace being arranged separately from the soaking pit, delivering the preheated cold steel billets to the inlet of the soaking pit, during which step the said preheated cold steel billets being turned over by 180 degrees and/or delivering the hot steel billets to the inlet of the soaking pit, charging successively the said preheated cold steel billets and/or the said hot billets into the soaking pit, allowing the steel billets to be subjected to soaking treatment in the soaking pit, while they are displaced in transfer grooves disposed in parallel to each other in the soaking pit, of which cross section is substantially an upwardly diverging trapezoid, and taking them to the subsequent rolling process out of the outlet of the soaking pit.

2. A method for soaking treatment of cold billets and/or hot billets as set forth in Claim 1, wherein the cold steel billets are first turned by 90 degrees at a turn groove located at the rear part of the preheating furnace and are second turned by another 90 degrees at a turn step located in place between the preheating furnace and the soaking pit.

3. A method for soaking treatment of cold steel billets and/or hot steel billets as set forth in Claim 1, wherein either the cold steel billets and the hot steel billets or mixture thereof are supplied, transferred, charged and displaced through the whole installation in the same longitudinal posture as they



accordance with the present invention therefore can adapt to any variation and modification to continue supply of steel billets 1 to the subsequent rolling process, keep the rolling process in continuous operation and reduce substantially running cost.

In addition a fact that the both soaking pit 10 and preheating furnace 20 are connected by way of the small flue 16, causing the exhaust gas from the soaking pit 10 to be utilized as thermal energy source for the preheating furnace, even though the said two furnaces 10 and 20 are separately build and another fact that there is provided no cooling means for the preheated cold billets 1A and the hot billets 1B at any rate will contribute to considerably increased thermal efficiency and reduced fuel unit cost.

Further since the temperature distribution through the preheating furnace 20 ranges from the considerable high temperature at the rear part of the preheating furnace 20, in which the exhaust gas is blown from the soaking pit 10, to the room temperature at the inlet thereof in the lower thermal level, preheating for the cold billets 1A in the preheating furnace 20 is effected such that it starts in lower temperature at the inlet thereof and thereafter temperature is increased gradually. Moreover a fact that the preheated cold billets 1A are rotated by 180 degrees on the way to the soaking pit 10 will ensure uniform heating in the soaking pit as well as very few oxide scale generated thereover.

Further another fact that the hot billets 1B are added to the soaking treatment in the soaking pit 10 will contribute to reduced thermal capacity of the thermal energy source 11 and remarkably reduced time length of soaking treatment, resulting in lowered thermal energy unit cost in the whole running cost, because the latent heat in the hot steel billet 1B itself can be advantageously utilized. Since fuel consumption at the thermal energy source 11 is substantially reduced in that way, total generation of Nox, Sox or the like will be minimized. This will contribute to prevention of public pollution, resulting in reduced preventive cost against pollution problems.

Another advantages with the arrangement and installation in accordance with the present invention are that each of the said devices 30, 40, 50, 60, 70, and 80 and the associated components are designed and constructed in a simple way and a series of operation is smoothly effected, since the preheating furnace is arranged in a right angle to the soaking pit 10, the transfer roller table 44 is arranged in parallel to the soaking pit 10, billets are laterally transferred with the aid of the third pusher 50 and the traverse transfer device 70 and billets are charged in the longitudinal direction with the aid of the charging device 80 so that billets are transferred in the predetermined direction from the inlet of the preheating furnace 20 into the soaking pit 10 by way of repeated lateral and longitudinal transfer movements without any plane rotation and any specific control for orientation of billet.

Moreover owing to a fact that each of the said devices 30, 40, 50, 60, 70, 80 and others is smoothly operated, the cold billets 1A and hot billets 1B are adapted to slide on the hearth 13 and 22 in the both

of soaking pit 10 and the preheating furnace 20 without any arrangement of movable device on the hearth as seen in the conventional walking beam, and any water cooling device and driving device as associated device are not required therefor, the installation and arrangement in accordance with the present invention can be simplified, be built at less initial construction cost and be operated at remarkably reduced running cost.

As mentioned above, characteristic features of the present invention lie in that either of cold billets in stockyard or the like and hot billets coming from blooming process or mixture of the same are successively subjected to soaking treatment and then continuously delivered to rolling process in good balance between rolling operation and soaking treatment and/or blooming process and soaking treatment, resulting in improved productivity and that preheating is carried out with the aid of exhaust gas which comes from the soaking pit after completion of soaking treatment, resulting in effective and improved usage of thermal energy involved in the exhaust gas, reduced running cost, minimized oxide scale and so forth.

As obvious from the above description of the preferred embodiment, it should be of course understood that the present invention may be modified and changed by any expert of the art without any departure from the spirit of the invention.

CLAIMS

1. A method for soaking treatment of cold steel billets and/or hot steel billets comprising in combination the steps of preheating the cold steel billets in a preheating furnace with the use of exhaust gas coming from a soaking pit, the said preheating furnace being arranged separately from the soaking pit, delivering the preheated cold steel billets to the inlet of the soaking pit, during which step the said preheated cold steel billets being turned over by 180 degrees and/or delivering the hot steel billets to the inlet of the soaking pit, charging successively the said preheated cold steel billets and/or the said hot billets into the soaking pit, allowing the steel billets to be subjected to soaking treatment in the soaking pit, while they are displaced in transfer grooves disposed in parallel to each other in the soaking pit, of which cross section is substantially an upwardly diverging trapezoid, and taking them to the subsequent rolling process out of the outlet of the soaking pit.

2. A method for soaking treatment of cold billets and/or hot billets as set forth in Claim 1, wherein the cold steel billets are first turned by 90 degrees at a turn groove located at the rear part of the preheating furnace and are second turned by another 90 degrees at a turn step located in place between the preheating furnace and the soaking pit.

3. A method for soaking treatment of cold steel billets and/or hot steel billets as set forth in Claim 1, wherein either the cold steel billets and the hot steel billets or mixture thereof are supplied, transferred, charged and displaced through the whole installation in the same longitudinal posture as they



took when they were supplied.

4. A method for soaking treatment of cold steel billets and/or hot steel billets as set forth in any of claims 1 to 3, wherein the whole combustion gas generated in the installation is discharged from the small flue located between the soaking pit and the preheating furnace.
5. A method for soaking treatment of cold steel billets and/or hot steel billets as set forth in any of claims 1 to 4, wherein charging device for charging the said cold steel billets and/or hot steel billets into the soaking pit and traverse transfer device for displacing laterally the said cold steel billets and/or hot steel billets are controlled in such a manner that during traverse transfer of the steel billets the charging device is retracted to the position prior to its operation, while during return movement of the traverse transfer device to the position prior to its operation of the charging device carries out its charging operation for the said cold steel billets and/or hot steel billets to be subjected to soaking treatment.
6. An apparatus for soaking treatment of cold steel billets and/or hot steel billets comprising in combination a soaking pit in which thermal energy sources such as oil burners are located at the upper part of the furnace wall and transfer grooves having a substantially upwardly diverging trapezoidal section are arranged on the hearth thereof in parallel to each other, a preheating furnace located by the side of the said soaking pit, the axes of the furnace and the pit being at a right angle one to the other, a small flue between the both furnaces to communicate the side portion of the soaking pit with the rear portion of the preheating furnace, a first pusher for charging a cold steel billet having a square section into the preheating furnace in a lateral posture, a second pusher located by the side of the rear part of the preheating furnace for pushing out the preheated cold steel billet through a turn groove onto a transfer roller table which is arranged by the side of the soaking pit in parallel thereto, the said preheated cold steel billet being turned by 90 degrees at the said turn groove located at the rear part of the preheating furnace, a third pusher located by the side of the inlet of the soaking pit for pushing the preheated steel billet on the said transfer roller table to displace it laterally and turn it by another 90 degrees at a turn step in the same direction as at the said turn groove, a supply roller table for supplying a hot steel billet having a square section coming from a preceding blooming process to dispose the same in juxtaposition with the said preheated cold steel billets, a traverse transfer device for displacing laterally the said preheated cold billets and/or the said hot billets thereon to locate the same in position in front of the inlet of the soaking pit, the said position corresponding to that of the transfer groove in the soaking pit, a charging device for charging the said preheated cold steel billets and/or the said hot steel billets into the transfer grooves of the soaking pit in the longitudinal direction and a delivery roller table for delivering the steel billets to the subsequent rolling process after completion of soaking treatment in the soaking pit.

7. An apparatus for soaking treatment of cold steel billets and/or hot steel billets as set forth in claim 6, wherein the said traverse device comprises a transfer stand in direct or indirect continuance with the transfer roller table via the turn step, which is flush with the upper surface of the supply roller table, and a plurality of chain transfers with an inclinable engagement pawl fastened thereto, which are adapted to be driven by means of driving source in both normal and reverse directions at a right angle to the direction of the displacement of the steel billets, the said engagement pawl standing upright during the normal movement of the chain transfers, while being lowered below the transfer stand during the reverse movement.
8. An apparatus for soaking treatment of cold steel billets and/or steel billets as set forth in claim 5 or 6, wherein the said charging device comprises a rail stand arranged in front of the inlet of the soaking pit in the direction of movement of the steel billets in the soaking pit, of which upper plane is located above the said traverse transfer device, a waggon mounted movably on the said rail stand, a plurality of pusher heads secured inclinably to the front portion of the waggon, a raising and lowering mechanism for raising and lowering the said pusher head and a driving mechanism mounted on the said waggon for moving the waggon in the forward and backward directions.
9. An apparatus for soaking treatment of cold steel billets and/or hot steel billets as set forth in claim 8, wherein the pusher head in the said charging device comprises a root part of which upper portion is fastened to a swing shaft pivotally mounted on the waggon at its front portion and a charging part which is adapted to abut against the preheated cold steel billets and/or hot steel billets at the extreme end thereof, the said both parts being integrally designed in a substantially L-form as seen from the side.
10. An apparatus for soaking treatment of cold steel billets and/or hot steel billets as set forth in claim 8, wherein the said pusher head is raised and lowered via a joint plate fastened to the said root part thereof with the aid of a pneumatic cylinder pivotally mounted at the front portion of the movable waggon, the top end of the cylinder rod being connected to the extreme end of the said joint plate.
11. An apparatus for soaking treatment of cold steel billets and/or hot steel billets as set forth in claim 8, 9 or 10 wherein the charging device has pushing force enough to displace the whole trains of steel billets in the transfer groove in the soaking pit.
12. An apparatus for soaking treatment of cold steel billets and/or hot steel billets as set forth in any of claim 6 to 11, wherein there is provided a control system whereby during traverse transfer of the said preheated cold steel billets and/or hot steel billets the charging device is retracted to the position prior to its operation, while during return movement of the traverse transfer device to the position prior to its operation the charging device carries out its charging operation for the said cold steel billets and/or hot steel billets to be subjected to soaking treatment.
13. An apparatus for soaking treatment of cold



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steel billets and/or hot steel billets as set forth in claim 6, wherein there is provided a pass line for temporary storage service for the steel billets, which is located adjacent to the inlet of the soaking pit on the opposite side to the third pusher, the upper plane of the said pass line being flush with the upper surface of the transfer stand of the traverse transfer device.

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