United States Patent [19]

Yoshihara et al.

[11] **3,921,274**

[45] **Nov. 25, 1975**

[54] **ASSEMBLING APPARATUS FOR SLIDING NOZZLE MOUNTED ON THE BOTTOM OF A LADLE**

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[22] Filed: **Jan. 14, 1975**

[21] Appl. No.: **540,926**

[30] **Foreign Application Priority Data**

Jan. 25, 1974 Japan 49-10221

[52] **U.S. Cl.** ..... **29/200 R;** 29/200 J; 29/200 P

[51] **Int. Cl.²** **B23P 19/00**

[58] **Field of Search** ..... 29/200 R, 200 P, 200 J; 73/49.4, 37

[56] **References Cited**

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[57] **ABSTRACT**

A bottom plate and a sliding plate constituting a sliding nozzle mounted on the bottom of a ladle for molten steel or the like are protected by their reinforcing metal holders. The present invention relates to an assembling apparatus for setting such bottom plate and sliding plate as well as the similar refractory pieces in the proper positions relative to their respective holders.

The apparatus comprises a carriage equipped with a rest on which is fixedly mounted a metal holder for a refractory plate of a sliding nozzle, a frame having an assembling station and a clamped condition check station and carrying thereon to carriage to be movable between and stoppable at either of the two stations, an expansion mechanism for supporting the body portion of the carriage directly on the frame at least at the clamped condition check station thereof, and pressure means arranged above the clamped condition check station of the frame and comprising a pressure member having a plurality of radial arms each provided on its lower end surface with a pin of a predetermined raised dimension, a hydraulic cylinder supported by a beam mounted on the frame and having a rod from one end of which is suspended the pressure member through a spherical seat bearing, and a stopper rod with a pointer having its one end attached to one of the radial arms and the other end fitted into a stopper holder attached to the beam.

1 Claim, 6 Drawing Figures

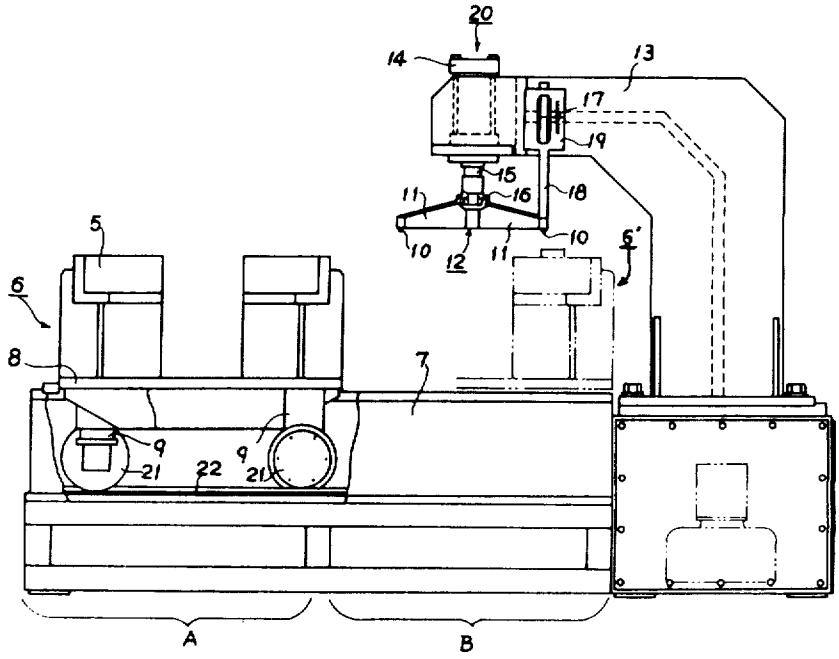


FIG. 1

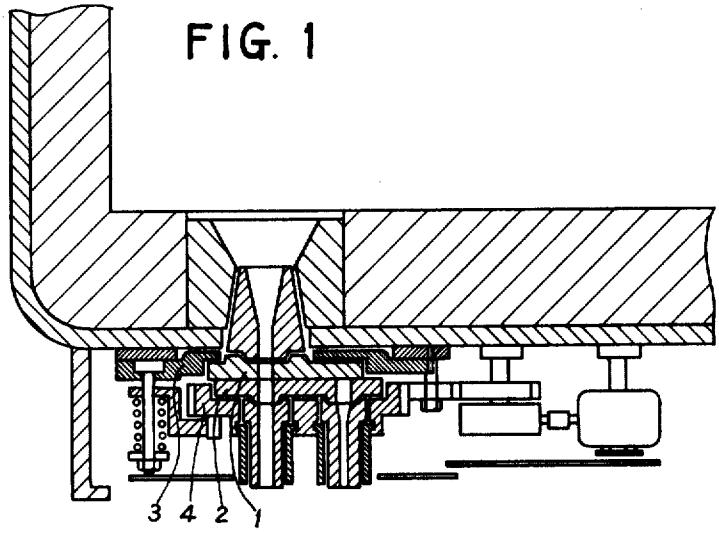


FIG. 2

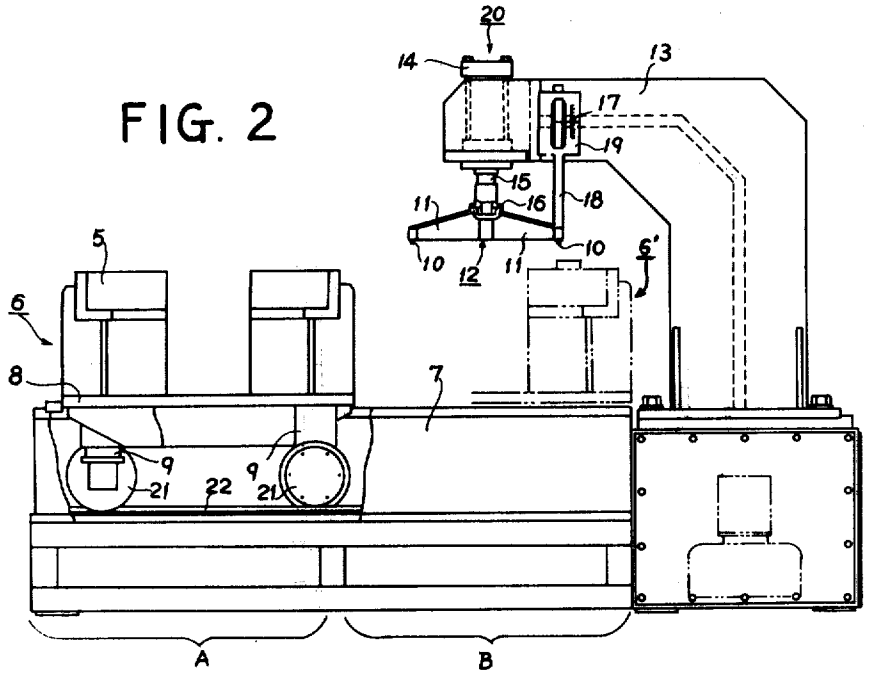


FIG. 3

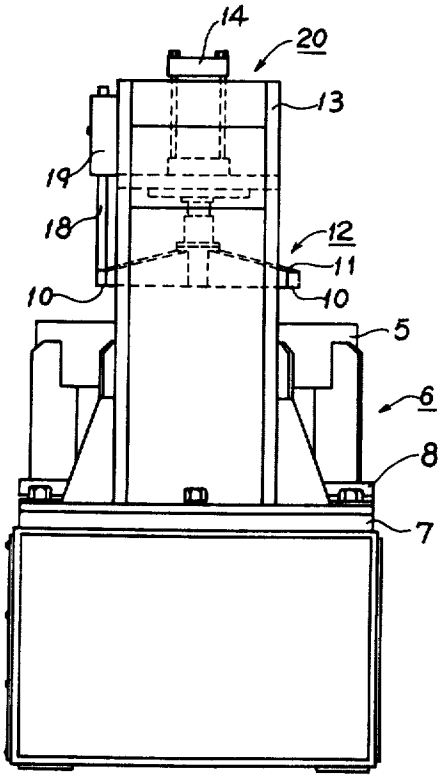


FIG. 4

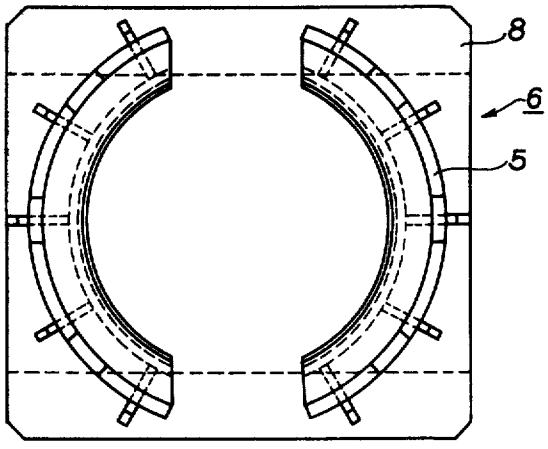


FIG. 5

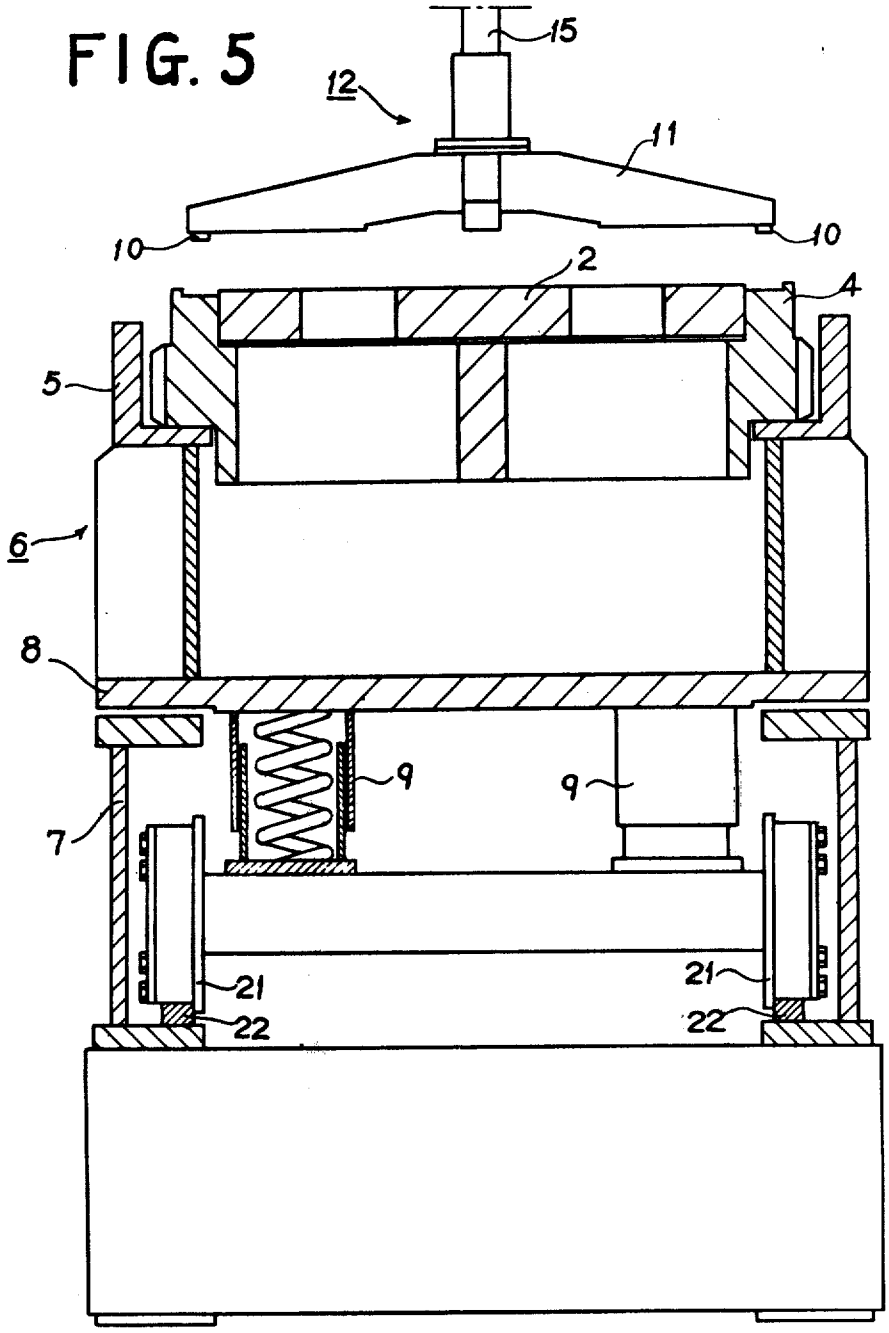
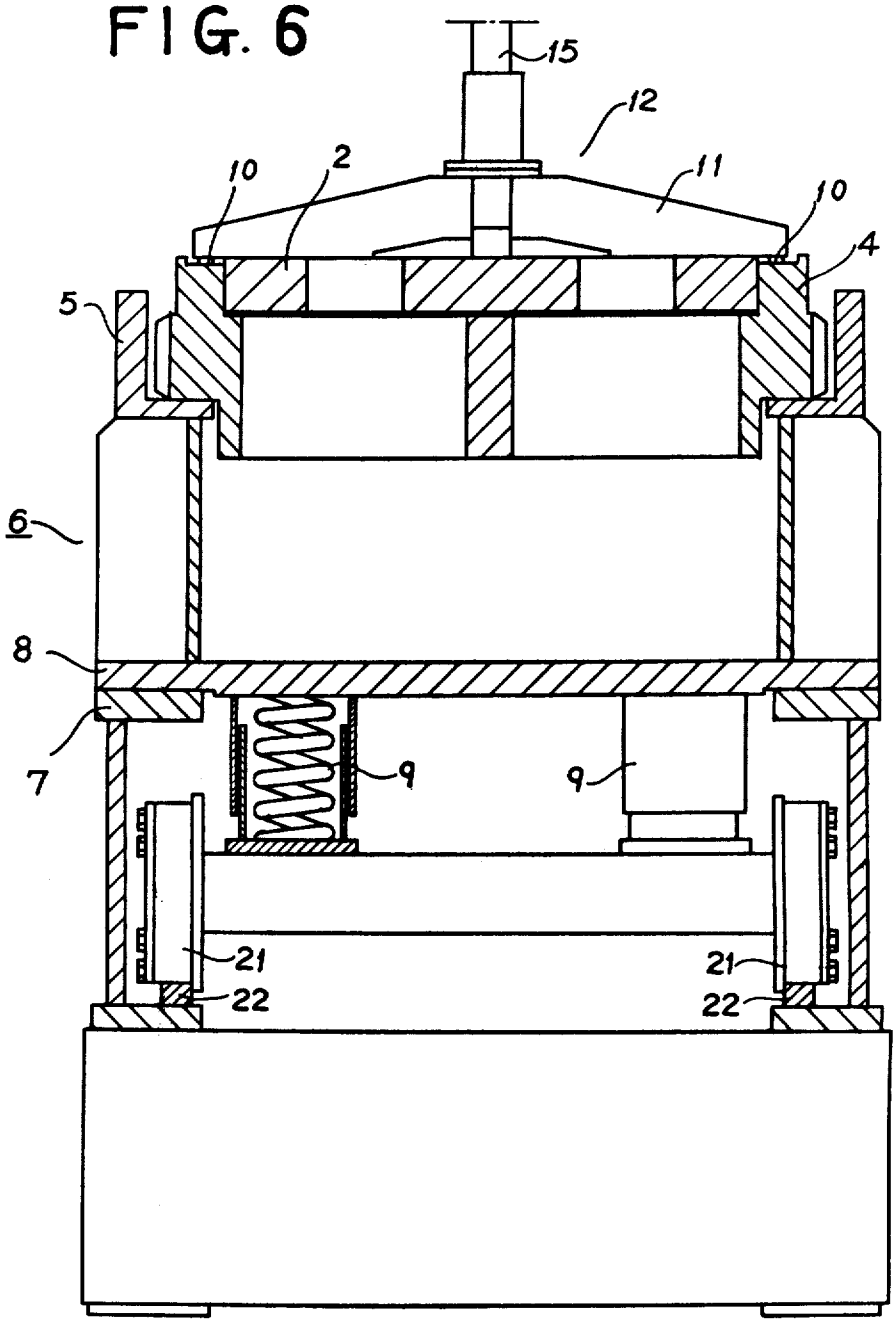


FIG. 6



ASSEMBLING APPARATUS FOR SLIDING NOZZLE MOUNTED ON THE BOTTOM OF A LADLE

BACKGROUND OF THE INVENTION

The present invention relates to a sliding nozzle refractory component parts assembling apparatus which is designed so that a refractory bottom plate and a refractory sliding plate constituting a sliding nozzle mounted on the bottom of a bottom pouring ladle for molten iron or the like are respectively inserted, clamped and secured to and removed from a metal bottom plate holder and a metal sliding plate holder. More particularly, the present invention relates to such a refractory component parts assembling apparatus which is designed so that the refractory bottom plate and refractory sliding plate of a sliding nozzle are set in their predetermined raised positions relative to their metal bottom plate holder and sliding plate holder in a manner that prevents the floating of the refractory plates during the clamping thereof, and moreover the set refractory plates can be checked accurately against their predetermined raised positions.

In a known type of sliding nozzle used with a bottom pouring ladle for molten iron or the like, as shown in FIG. 1 of the accompanying drawings, a refractory bottom plate 1 and a refractory sliding plate 2 are respectively inserted, clamped and secured to a metal bottom plate holder 3 and a metal sliding plate holder 4 for assembling into a sliding nozzle assembly.

In this case, in assembling the refractory bottom plate 1 inserted into the metal bottom plate holder 3 and the refractory sliding plate 2 inserted into the metal sliding plate holder 4 into a sliding nozzle assembly, each of the refractory bottom plate 1 and the refractory sliding plate 2 is inserted into the associated holder to project to a predetermined height from the edges of the latter to allow the contact surfaces of the refractory plates 1 and 2 to be closely pressed against each other, and consequently the refractory plates are assembled in the resulting sliding nozzle to provide an accurate surface-to-surface contact therebetween.

In this case, since the sliding nozzle assembly employs a spring mechanism to ensure a close contact between the component parts, particularly between the mating surfaces of the refractory bottom plate 1 and the refractory sliding plate 2, unless the refractory bottom plate 1 and the refractory sliding plate 2 are raised to a certain height from their respective metal holders 3 and 4, the closeness of the contact between the refractory plates is reduced and this gives rise to a leakage of molten iron, etc. while in service, thus leading to a serious accident.

Therefore, when such a sliding nozzle is to be employed, it has been considered particularly important to insert and securely mount the refractory bottom plate 1 and the refractory sliding plate 2 in their respective holders 3 and 4 to project to a predetermined height from the latter. uniform height. Further,

In the past, in inserting and setting the above-mentioned refractory bottom plate 1 and the refractory sliding plate 2 in their respective metal holders 3 and 4, it has been customary to insert the refractory bottom plate 1 and the refractory sliding plate 2 in their respective metal holders 3 and 4, to insert a stiffening plate between the side face of each metal holder and the associated refractory plate to secure the latter in place

and to clamp them together by means of bolts. However, due to the fact that the refractory plates tend to float when they are clamped together, the refractory plates are clamped together while pounding them with a rubber hammer, thus causing variations in the set heights of the refractory plates and making it difficult to make all of unifirm height. further, the shock due to the pounding of the refractory plates with the rubber hammer tends to cause cracking of the refractory plates. Furthermore, the actual operation involving the pounding of the refractory plates with the rubber hammer presents an operational problem of requiring at least two operators for the hammering and clamping operations.

SUMMARY OF THE INVENTION

With a view to overcoming the foregoing difficulty, it is the object of the present invention to provide an assembling apparatus for a sliding nozzle mounted on the bottom of a ladle whereby when a refractory bottom plate and a refractory sliding plate are inserted and securely mounted in their respective metal holders so that the floating of the refractory bottom plate and the refractory sliding plate is prevented, each of the refractory plates is set to a predetermined raised height, and the set heights can be easily checked with a high degree of accuracy.

In accordance with the present invention, there is thus provided an assembling apparatus for refractory component part of a sliding nozzle mounted on the bottom of a ladle comprising a carriage equipped with a rest on which is fixedly mounted a metal holder for a refractory bottom plate or a refractory sliding plate of a sliding nozzle, a frame having an assembling station and a clamped condition check station and carrying thereon the carriage to be movable between and stoppable at either of the two stations, an expansion mechanism for supporting the body portion of the carriage directly on the frame at least at the clamped condition check station thereof, and pressure means arranged above the clamped condition check station of the frame and comprising a pressure member having a plurality of radial arms each provided on its lower end surface with a pin of a predetermined raised dimension, a hydraulic cylinder supported by a beam mounted on the frame and having a rod from one end of which is suspended the pressure member through a spherical seat bearing, and a stopper rod with a pointer having its one end attached to one of the radial arms and the other end fitted into a stopper holder attached to the beam.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional side view of a conventional rotary type sliding nozzle mounted on the bottom of a ladle, showing particularly the relative positions of the component parts of the sliding nozzle.

FIG. 2 is a front view of an embodiment of an assembling apparatus according to the present invention.

FIG. 3 is a side view of FIG. 2.

FIG. 4 is a plan view of the carriage used in the embodiment of FIG. 2.

FIG. 5 is a section taken through the central portion of the carriage at a clamped condition check station (B), showing the relative positions of the clamped condition checking pressure member, the refractory piece

and the metal holder which are in condition for clamped condition checking operation.

FIG. 6 is a sectional view similar to FIG. 5, showing the relative positions of the same elements during the clamped condition checking operation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described in greater detail with reference to the illustrated embodiment.

As shown in FIGS. 2 and 3, the assembling apparatus for refractory component parts of a sliding nozzle according to the present invention comprises, a carriage 6 provided on the upper surface thereof with a rest 5 adapted for mounting in a predetermined position thereon a metal holder 3 or 4 for a refractory bottom plate 1 or a refractory sliding plate 2 of a sliding nozzle such as shown in FIG. 1, a frame 7 having an assembling station A and a clamped condition check station B and adapted for carrying the carriage 6 to be movable between and stoppable at either of the two stations without any rolling, extension devices 9 adapted for directly supporting a body portion 8 of the carriage 6 on the frame 7 at least at the clamped condition check station of the frame 7, and pressure means 20 arranged above the clamped condition check station of the frame 7 and having a pressure member 12 including a plurality of radial arms 11 each provided on its lower end surface with a pin 10 of a predetermined raised dimension and suspended by way of a spherical seat bearing from the front end of a rod 15 of a hydraulic cylinder 14 supported by a beam 13 mounted on the frame 7, with one of the arms 11 being provided with a stopper rod 18 having a pointer 17 and fitted into a stopper holder 19 attached to the beam 13.

As shown in FIG. 4, the rest 5 on the upper surface of the carriage 6 is divided into two parts so that the metal holder 3 or 4 which has been mounted and conveyed on a jig for easy conveyance may be placed as such on the rest 5, and the thus placed metal holder may be removed by means of the jig after the assembling has been checked. The illustrated rest 5 is constructed so that either of the metal holders 3 and 4 may be placed on the rest 5, and the rest 5 may be modified as desired in accordance with the specification of a sliding nozzle to be assembled. On the other hand, the carriage 6 is movable on a pair of rails 22 on the frame 7 by means of wheels 21, so that not only rolling of the carriage 6 moving between the assembling station A and the clamped condition check station B is prevented, but also it is possible to accurately move the carriage 6 to a predetermined halting position at each of the two stations.

Arranged between the wheels 21 and the body portion 8 of the carriage 6 are a plurality of expansion devices 9 each consisting of a spring or the like, so that when a refractory subassembly consisting of a refractory bottom plate or a refractory sliding plate inserted in the associated metal holder is mounted on the carriage rest 5, as shown in FIG. 5, the body portion 8 of the carriage 6 is raised from the upper surface of the frame 7 to movably hold the carriage 6, whereas when the carriage 6 is subjected to a pressing pressure at the clamped condition check station as shown in FIG. 6 and in the manner that will be described later, the carriage body portion 8 is directly supported on the frame 7. The pressure means 20 arranged above the clamped condition check station B of the frame 7 include a pressure member 12 which, in the illustrated embodiment, comprises the four crossed arms 11 and which is tiltably (oscillatably) suspended from the front end of the rod 15 of the hydraulic cylinder 14 through the spherical seat bearing 16, and each of the arms 11 is provided on its lower end surface with a pin 10 of a raised dimension corresponding to a predetermined raised height of the refractory bottom plate 1 or the refractory sliding plate 2 with respect to the metal holder 3 or 4.

In addition, one of the arms 11 is provided at its front end with the stopper rod 18 which has the pointer 17 mounted on a part thereof, and the stopper rod 18 is fitted into the stopper hold 19 mounted on the beam 13 and provided with index marks so as to indicate the elevated position of the pressure member 12 from the upper surface of the frame 7, and at the same time the stopper rod 18 limits the rotational movement of the pressure member 12.

In operating the sliding nozzle assembling apparatus of the invention constructed as described above, firstly the metal holder 4 is for example placed on the rest 5 of the carriage 6, the refractory sliding plate 2 is fitted into the metal holder 4 after a suitable number of height adjusting soft metal plates such as aluminum plates have been placed between the lower surface of the refractory sliding plate and the metal holder 4 and, after fitting caulking pieces, the refractory plate locking supports of the metal holder 4 are roughly locked by means of screws for temporary clamping. These operations are carried out at the assembling station A as shown in FIG. 5, and in this condition the carriage 6 is raised from the upper surface of the frame 7 so that the entire load is supported by the wheels 21 and hence the carriage 6 is movable on the rails 22.

When the above-described temporary clamping operation has been completed, the carriage 6 is moved to the clamped condition check station B as indicated at 6' in FIG. 2.

Above the carriage 6 stopped in place at the station B, the hydraulic cylinder 14 is operated to lower the pressure member 12 so that the pressure member 12 presses the refractory sliding plate 2 as shown in FIG. 6. In this state, since the lower surface of the arms 11 press the upper surface of the refractory sliding plate 2 and hence the pins 10 come into contact with the upper surface of the metal holder 4 around the refractory sliding plate 2, the body portion 8 of the carriage 6 is directly supported by the frame 7 through the action of the expansion devices 9. Consequently, the same functional effects may be obtained, if, instead of mounting the expansion devices 9 on the carriage 6 as in the illustrated embodiment, the expansion devices 9 are mounted in such a manner that the rails 22 are caused to go down when the expansion devices 9 are pressed at the clamped condition check station B.

In this pressed condition, the pins 10 are all brought into contact with the metal holder 4 in the above-mentioned manner so that if the lower surface of the arms 11 are all in contact with the upper surface of the refractory sliding plate 2, it is an indication that the refractory sliding plate 2 and the metal holder 4 are in the properly set condition, and in this case the pointer 17 indicates the O mark or the mark corresponding to a preselected value.

When this occurs, the refractory sliding plate **2** and the metal holder **4** which have been clamped temporarily in the abovementioned manner are further clamped into a final clamped condition, thus assembling an accurately set refractory subassembly.

Further, during the above-mentioned check on the clamped condition, the condition of contact between the pins **10** and the metal holder **4** and between the arms **11** and the refractory sliding plate **2** can be easily determined, and moreover any irregularities such as the inclination of the refractory plate with respect to its metal holder, incorrectly raised height of the refractory plate with respect to the metal holder as well as the degree of such irregularities can be easily determined by the indication of the pointer **17** to immediately take the necessary measures to correct the irregularities.

It will thus be seen from the foregoing description that the present invention has a great industrial utility value in that particularly in assembling a sliding nozzle mounted on the bottom of a ladle, the sliding nozzle can be assembled in such a manner that each of the refractory plates is always maintained in a predetermined raised position with respect to its metal holder to prevent floating of the refractory plates during a clamping operation, and moreover the degree of irregularity of the set conditions can be easily grasped.

What is claimed is:

1. An assembling apparatus for refractory component parts of a sliding nozzle mounted on the bottom of a ladle comprising a carriage having a rest for securely mounting thereon a metal holder for a refractory bottom plate or a refractory sliding plate of said sliding nozzle, a frame having an assembling station and a clamped condition check station and adapted for mounting thereon said carriage to be movable without rolling between and stoppable at either of said stations, expansion means adapted for directly supporting the body portion of said carriage on said frame at least at said clamped condition check station thereof, and pressure means disposed above said clamped condition check station of said frame and including a pressure member suspended through a spherical seat bearing from one end of a rod of a hydraulic cylinder carried on a beam mounted on said frame, said pressure member having a plurality of radial arms each thereof provided on the front end lower surface thereof with a pin of a predetermined raised dimension, one of said radial arms provided with a rotation stopper rod having a pointer and fitted into a rotation stopper holder attached to said beam.

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