TONG DEVICE FOR METAL SCRAP BLOCKS
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Filed Apr. 24, 1967, Ser. No. 633,105
Claims priority, application Japan Dec. 29, 1966, 41/85,660
Int. Cl. B66C 1/28
U.S. Cl. 294—106

3 Claims

ABSTRACT OF THE DISCLOSURE

The present invention involves a device for supporting scrap metal blocks by means of tong arms for introduction into furnaces in which the blocks are to be melted; the construction of the device being such that the blocks are readily released by the device when deposited in the furnace whereafter the device is removable from the furnace without damaging the walls of the furnace.

BACKGROUND OF THE INVENTION

In the past, cables, wires, chains, and the like have generally been used for supporting and transporting metal scrap blocks for introduction into a furnace. Where cables, for example, are used, the metal scrap block is first held by such cables and then the block thus held is elevated and transported to an electric furnace by crane means. With such conventional method molten metal, which is usually present at the bottom of the furnace, will adhere to the supporting cables should the block thus suspended be lowered to engage the bottom of the electric furnace, and hence the cables may be rendered useless for their intended use or alternately the furnace bottom may be damaged due to shocks resulting from blocks dropping into the furnace should the cables be removed from the block before the latter reaches the pool of molten metal at the furnace bottom. Furthermore, when using cables, it will obviously be difficult to suspend a scrap block in a desired position in the electric furnace.

SUMMARY OF THE INVENTION

The present invention comprises a device for supporting metal scrap blocks. The device has a plurality of tong arms each having opposite ends one of which is formed with an offset portion adapted to engage a surface of a scrap block. The device further includes a plurality of pairs of pivotally connected toggle links, the end of each tong arm opposite said end thereof being pivotally connected to a separate one of said plurality of toggle links at said pivotal connection thereof. Each of the tong arms has an intermediate portion thereof mounted for movement about a fixed pivot when the free ends of each of said pairs of toggle links are moved toward and away from each other, means being provided for so moving the free ends of each of said pairs of toggle links.

Preferably, the intermediate portion of each of said tong arms is mounted on a unitary frame for movement about the fixed axis. Also for moving the free ends of each of the pairs of toggle links I preferably provide a pair of spaced apart movable members with one of the free ends of each of the pairs of toggle links being fixedly connected to one of said pair of members, the other free ends of each of the pairs of toggle links being fixedly connected to the other said pair of members.

With the foregoing construction of the device, in accordance with the invention, when one of the members is moved toward the other member the pivotal connection between the toggle links and one end of the tong arm will cause the other end of each tong arm to move about its fixed pivot in the frame in a direction to move the tong arms inwardly into a position to grasp a scrap block incident to its placement in a furnace, and when one of the members is moved away from the other, the laterally offset end of the tong arms will be moved outwardly to a position in which the block is released enabling withdrawal of the device from a furnace after the block has been deposited therein by the device of the invention. Preferably the members are moved relatively to one another by cables the operation of which can be simply controlled to ensure from damage to either tong arms while in the furnace or to the walls of the furnace when either introducing the device into or removing it from the furnace.

The device of the invention has particular utility when utilized in conjunction with a cylindrical scrap block formed with longitudinal recesses in the outer periphery thereof. In this case the tong arms which are preferably tapered down toward the offset end portion of the arm, have a maximum width which is equal to or less than the width of the recesses formed in the block.

Preferably more than three tong arms are provided while the length and width thereof will obviously depend upon the shape and dimensions of the metal scrap block to be supported and transported by the device in accordance with the invention.

Objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view of the device in accordance with the invention;
FIG. 2 is a vertical section taken through line II—II of FIG. 1;
FIG. 3 is a horizontal section taken through line III—III of FIG. 1;
FIG. 4 is a vertical section of the tong arm portion of the device illustrating the use of the device with a slotted metal scrap block;
FIG. 5 is a perspective view of a slotted metal scrap block;
FIG. 6 is a partly cut away, enlarged, front view of another embodiment of a device in accordance with the invention; and
FIG. 7 is a schematic illustration of the device of the invention in conjunction with a metal scrap block in position in a regenerative furnace.

With reference to FIGURES 1, 2 and 3, the device of the invention includes a shaft 1 having opposite threaded ends and to which is secured at the upper end thereof an upper plate 2 and at the lower end thereof a lower plate 4, by means of nuts 2a, 4a respectively. The shaft 1 slidably guides a sliding plate 3 disposed substantially parallel and between the upper and lower plates 2 and 4. On the top of said upper plate 2 there is provided a projecting ring 5 with which hook 24a of another wire cable 24 suspended from an overhead crane apparatus C (see FIG. 7), is engaged. Also at the top of the sliding plate 3 there are provided two rings 14 which are interconnected by means of a traction wire 23 adapted to be engaged by a hook 24a of another wire cable 24 suspended from the crane apparatus. The sliding plate 3 and lower plate 4 are preferably identically shaped, each having in the disclosed embodiment, four arms, plate 3 being provided with arms 6 and plate 4 being provided with arms 9, the arms 6 and 9 being equally spaced with respect to one another. In any event, plates 3 and 4 will be formed with arms the numbers of which will correspond to the number of tong arms.

For coupling both plates 3 and 4, we preferably provide toggle joint means which in the present embodiment consists of four pairs of links, each pair of links being pivotally connected by pivots 13. Each pair of links com-
prises link 7 on the one hand and link 10 on the other hand, link 7 and link 10 preferably being of the same length. As will be seen from FIG. 2, the free end of link 7 of each pair of links is pivotally connected to the arms 6 of the casting plate 3 by means of pin 1, and the free end of the other link 10 is pivotally connected to the arms 9 of the lower plate 4 by means of pins 11.

Four tongs 12 are provided each being of a bell crank form and each comprising longer arm portion 12a and shorter arm portion 12b whose end is pivotally connected by means of pivot 13 to the pivotally connected end of each of the pairs of links 7, 10. The end of the long arm portion 12a is laterally offset to form a hook for engaging a metal scrap block. For translating tongs 12 about a fixed pivot there is provided a frame 15 which is generally annular and which is provided with arms 17 which are slotted 18, the arms 17 being equally spaced from one another. As illustrated in FIG. 1, an intermediate portion of the tongs 12 is fixedly pivotally connected to the arms 17 of frame 15 by means of pins 19.

The operation and use of the device of the invention for lifting and transporting a metal scrap block B will now be described with reference to FIG. 7, the block B as illustrated in this figure being cylindrical and having a truncated conical bottom D.

First, the ring 5 of the upper plate 2 is engaged by the hook 22 suspended from wire 23 in turn suspended from an overhead crane apparatus C mounted on traverse rail 24 and the ring 5 is engaged by hook 24 provided on wire cable 24 of the crane apparatus. The device of the invention is lifted by winding wire 22 by means of a winch of the crane apparatus and is moved to a position over a metal scrap block. When wire 24 is wound by the winch the sliding plate 3 is moved upwardly on shafts 9, thereby causing the end of link 7 connected to plate 3 to be moved away from link 10.

Accordingly, by virtue of the pivotal connection of the tongs 12 with links 7, 10 and its fixed pivotal connection with frame 15, the intermediate portion of each tong will swing about pivot 19 acting as a fulcrum, and with plate 3 moved upwardly by winding wire 24 by means of the winch, it will be obvious to those skilled in the art that the offset end portion of each tong will move outwardly. With the tongs 12 spread outwardly as just described, the device of the present invention is lowered and the tongs 12 are positioned about the periphery of the block. With the device in this position wire 24 is loosened to cause each of the tongs 12 to return to its original position by virtue of the weight of arm portion 12a and the sliding plate 3. In such original predetermined position of tongs 12 arms 12a contact the peripheral surface of the block at the same time its hooked offset end engages the bottom of the block. Winding the wire 22 under this condition causes the tongs 12 to securely hold and lift said block B. In this regard, as wire 22 is wound, it will be apparent that lower plate 4 will be raised, thereby causing the end of link 10 connected to plate 4 to be moved toward link 10. Movement of link 10 toward link 7 causes the offset end portions of each tong to move inwardly to increase the hold on said block B. With the block B firmly held by the tongs 12, the device of the invention is lowered together with the block B to a regenerative furnace E. When the block B engages the bottom of the furnace, the wire 24 is again wound, and, as previously described, when wire 24 is wound each of said tongs 12 will be moved away from each other to release its hold on the block. Thereafter, the wire 22 is again wound to effect removal of the device from the bottom of the block.

By virtue of the foregoing arrangement it will be obvious that by essentially adjusting the traction on wire 23 the extent to which the metal scrap block is held by each of the tongs 12, especially by the hooks 20 at the bottom of the block, may be selectively regulated. The operation of the device of the invention is simple and requires no special skill since obviously the position of tongs relative to the metal scrap block can be readily manipulated by merely manipulating wire cables 22 and 24 respectively associated with shaft 1 and traction wire 23. Moreover, by virtue of the pivotal mounting of the intermediate portion of each tong arm to the frame 15 by means of pivot pin 19, the opening and closing movements of the tongs may be effected in narrow furnaces without damage to the furnace wall.

In FIG. 5 is shown a metal scrap block B which is cylindrical and provided with a plurality of slots or recesses of substantially the same depth, each slot extending longitudinally of the block.

For supporting and transporting a block as shown in FIG. 5, the device shown in the foregoing FIGURES 1, 2 and 3 may be utilized except as shown in FIG. 4, the longer arm 25a of the tongs 25 is tapered inwardly to a greater extent than with the device of FIGS. 1 to 3. In FIG.4, the wider part of the upper portion of arm 25a is substantially as wide as the depth of slot 21 in the metal scrap block B. Thus, when said tongs are positioned in the slots 21 of the block, the tong arm will not project from the side of the block in the manner described for FIG. 5. Said arm 25a being tapered inwardly, the tong may be moved in and out of engagement with the block B entire within the slotted section of the block. In the circumstances, maximum volume blocks can be placed in the furnace by following the sequence of operation hereinafore described and accordingly the production rate may be increased by the provision of an additional traction means for positively lowering the sliding plate 3 for moving tongs 12 to a holding position. In the FIG. 6 embodiment, the sliding plate 3 is provided with rings 27 on each of the two opposing sides of the plate. Additionally, two rollers 28 are carried by lower plate 4 on each of the two opposing sides thereof. A traction wire 29 is connected to one of the rings 27 on one side of plate 3, is then passed over one of the pairs of rollers 28 on that side of the plate 4 whereafter wire 29 is drawn upwardly, reversely bent, passed over the other pair of rollers 28 on the other side of plate 4 for connection, the other end of wire 29 engaging a hook 30a of a further wire cable 30 suspended from the crank apparatus. Advantageously, wire cable 30 may be reversely wound a hoist drum (not shown in the drawings) associated with the winch for wire cable 24. The upper plate 2, sliding plate 3 and lower plate 4 are each provided with rings 31 for guiding movement of traction wire 29. In this embodiment of the invention, each of the tongs 12 may be moved outwardly by elevating wire 23 as in the previously described embodiments, and the tongs can be positively closed by elevating wire 29.

The arrangement described with respect to FIGURE 6 may obviously also be used in the FIG. 4 embodiment for positively moving slide plate 3 downwardly after it has been elevated by the traction wire.

What is claimed is:

1. A device for supporting scrap blocks, said device comprising a plurality of tong arms each having opposite ends one of which is formed with an offset portion adapted to engage a surface of a scrap block, a plurality of pairs of pivotally connected toggle links, the end of each tong arm opposite said one end thereof being pivotally connected to a separate one of said pluralities of toggle links at said pivotal connection thereof, and an annular frame, each of said tong arms having an intermediate portion directly and pivotally connected to the frame for movement about a fixed pivot when the free ends of each of said pairs of toggle links
are moved toward and away from each other, and means independent of the frame for so moving the free ends of each of said pairs of toggle links, said moving means comprising a pair of substantially parallel spaced apart relatively movable members, one of the free ends of each of the pairs of toggle links being fixedly connected to one of said pair of members, the other free ends of each of the pairs of toggle links being fixedly connected to the other of said pair of members.

2. A device according to claim 1, including a movable shaft for guiding movement of one of said members relative to said shaft, a ring structure being mounted on said shaft and being adapted for engagement with a crane hook and said one of said members being operatively connected to traction means for moving said one of said members relative to said shaft and independently of the other of said pair of members fixedly attached to said shaft for movement therewith.

3. A device according to claim 1, in which each tong arm is tapered toward said one end thereof, said arm having a width no greater than the depth of slots in the scrap blocks adapted to be supported by said offset portion of each of said arms.

4. A device according to claim 2, wherein said traction means comprise traction cables coupled to rings mounted on said one of said members the arrangement being such that when said traction means is under traction said one of said members is moved upward to cause said opposite ends of each of the tong arms, by virtue of the connection of said tong arms to said toggle links and to said frame, to move outwardly away from one another, said tong arms being moved inwardly toward one another by virtue of the weights of said tong arms and said one of said members.

5. A device according to claim 2, wherein said traction means comprise traction cables, one of which is operatively connected to said one of said members for raising the same and another of which is operatively connected about rollers at the lower end of said shaft for lowering said one of said sliding members.

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