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LIFTING APPARATUS
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FIG. 1.

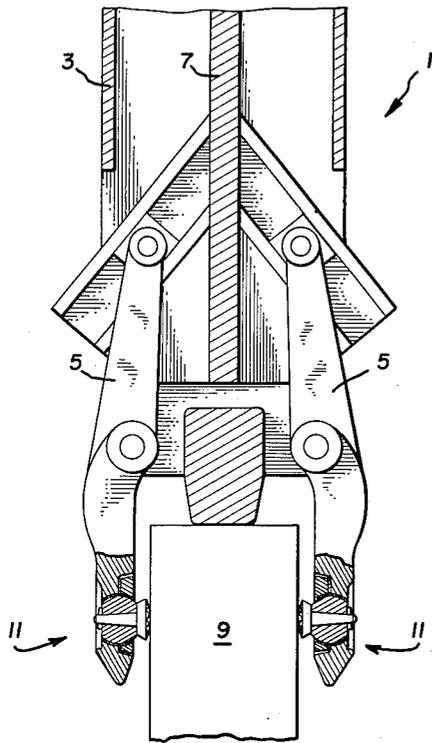


FIG. 2.

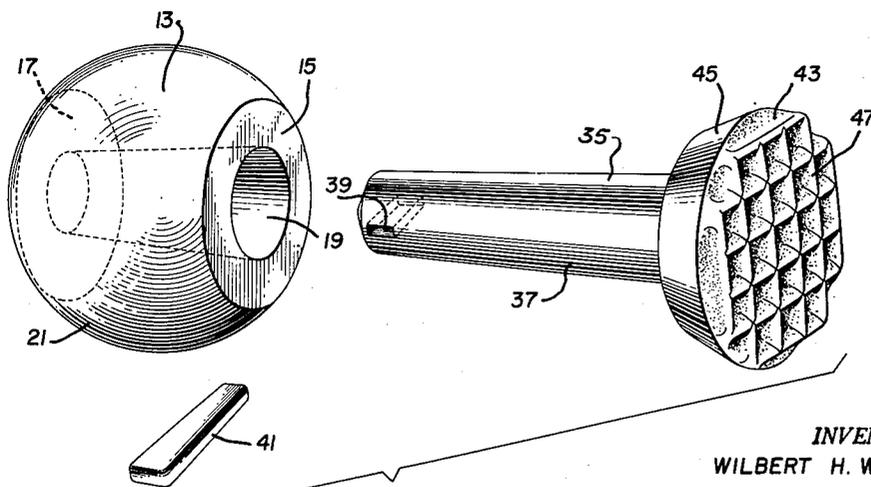
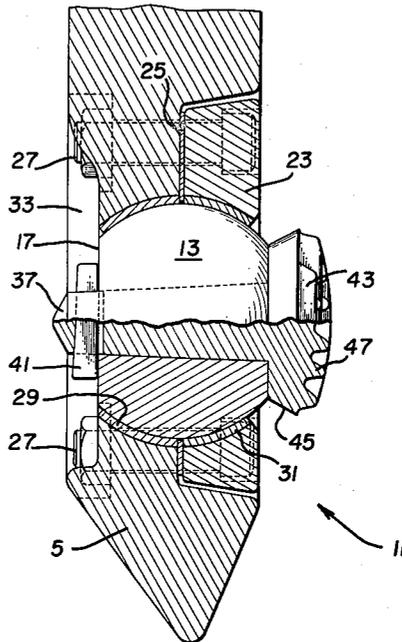


FIG. 3.

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1

3,061,357

LIFTING APPARATUS

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2 Claims. (Cl. 294-106)

The present invention relates to lifting apparatus, and more particularly to tongs having improved tong bit structure. The invention has utility in a variety of environments and will be illustrated by way of example in connection with ingot tongs.

In the past, tongs for lifting very heavy objects such as ingots have been provided with tong bits which were sharply pointed so as to bite into the ingot and prevent the ingot from slipping from between the tongs during lifting. Such sharp pointed bits had the advantage of permitting the ingot to swing between the tongs, so that an ingot resting on its side, although picked up at one end, would nevertheless be carried in a vertical position. However, such bits left holes in the ingot, and these holes did not close during subsequent shaping operations but were carried over into the slabs and blooms rolled from the ingots.

In an effort to prevent such piercing of the ingots, it was proposed to extend the surface over which the bits contacted the ingots, by providing each bit with a plurality of knobs or projections disposed in a common plane and by mounting the bits for universal movement relative to the tongs. The purpose of this arrangement was to permit all of the knobs on the bits to swing into engagement with the ingot when the ingot was first grasped, after which there would be no movement of the bits relative to the ingot and the bits and ingot would swing as a unit relative to the tongs. It was found, however, that when this latter arrangement was incorporated in heavy ingot tongs, the bits tended to stick in their initial positions when the ingot was first grasped, when the result that one of the knobs at the edge of the group of knobs on the bit dug into the ingot. Thus, the force of the bits on the ingots was not distributed over a plurality of knobs. When that force was reduced sufficiently to prevent marring the ingot, the ingot slipped relative to the bits.

Accordingly, it is an object of the present invention to provide lifting apparatus having tong bits which will engage the work firmly but without damaging the surface of the work.

Another object of the present invention is the provision of lifting apparatus having improved tong bit structure that will be relatively simple and inexpensive to manufacture and install, easy to operate, maintain and repair, and reliable, rugged and durable in use.

Other objects and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawing, in which:

FIGURE 1 is an elevational view partly in cross section of lifting apparatus according to the present invention;

FIGURE 2 is an enlarged fragment of FIGURE 1; and

FIGURE 3 is an exploded perspective assembly view of tong bit structure according to the present invention.

Referring now to the drawing in greater detail, there is shown lifting apparatus comprising ingot tongs indicated generally at 1 and including a frame 3 adapted to be carried by a crane in the usual manner. A pair of ingot tongs 5 are mounted intermediate their lengths for pivotal movement about parallel axes on opposite lower sides of frame 3 for conjoint swinging movement in opposite directions about parallel horizontal axes. A cam assembly 7 is carried by but is vertically reciprocable relative to the remainder of frame 3 and engages slidably with the upper ends of tongs 5 so as to move these upper ends

2

selectively toward or away from each other thereby to move the lower ends of tongs 5 away from or toward each other respectively so as to permit grasping, lifting or releasing an ingot 9 from or between tongs 5. The structure described thus far is quite conventional in this art and by itself forms no part of the present invention. Specifically, it may take the form shown in Harry Patent No. 2,219,479, October 29, 1940 to which reference is made for a more specific disclosure so as to avoid unnecessary repetition of the description of conventional structure embodied in the device.

Adjacent the lower ends of tongs 5, tong bits 11 are provided which confront each other. Each bit 11 comprises a ball 13 which is spherical except that it has opposed flat parallel surfaces 15 and 17 of circular outer contour. A tapered bore 19 of truncated conical configuration extends entirely through ball 13 coaxially of surfaces 15 and 17, so that surfaces 15 and 17 are actually annular about bore 19. The axis of bore 19 includes the centroid of ball 13. The remainder of the outer contour of ball 13 is comprised by a spherical surface 21.

An opening extends entirely through the lower end of each tong 5 for the reception of bit 11. The inner side walls of the opening are spherical; and when ball 13 is seated in the opening, these spherical side walls are concentric with ball 13. In the seated position, a cap 23 seats in a recess in the inner side of each tong 5 about ball 13, cap 23 having an opening entirely therethrough having spherical inner side walls which are also concentric with ball 13 when cap 23 is in place and which form continuations of the spherical side walls of the opening through the remainder of tong 5. A shim 25 is disposed in a vertical plane which includes the centroid of ball 13, between cap 23 and the remainder of tong 5. Shim 25 has a circular opening therethrough of a diameter equal to the diameter of ball 13; and the marginal edges of this circular opening extend radially inwardly beyond the adjacent inner side edges of the spherical surfaces which define the openings through cap 23 and the remainder of tong 5 in which ball 13 is seated. Nut and bolt assemblies 27 extend through cap 23 and the remainder of tong 5 to hold cap 23 detachably in place and to retain ball 13 removably within tong 5. A bearing sleeve 29 in the form of a truncated cylindrical shell lines the opening through tong 5 on one side of shim 25, and a bearing sleeve 31 lines the opening through that portion of tong 5 comprised by cap 23 on the other side of shim 25. The marginal edges of the circular opening through shim 25 are disposed between and space sleeves 29 and 31 apart a distance equal to the thickness of shim 25. Sleeves 29 and 31 are of uniform thickness throughout; and their internal spherical surfaces are complementary to and in sliding bearing contact with and relative to spherical surface 21 of ball 13. Tong 5 is recessed on its rear or outer side as at 33 entirely about ball 13; and the heads of nut and bolt assemblies 27 are disposed at one end in recess 33 and at the other end in recesses in cap 23.

Mounted on ball 13 is a replaceable bit piece 35 including a tapered shank 37 of an outer contour complementary to the internal contour of bore 19. A slot or key-way 39 extends diametrically through the smaller end of shank 37 for the reception of a tapered wedge or key 41 which bears against surface 17 and holds shank 37 firmly seated in bore 19. Key 41 is disposed within the contour of recess 33 and is thus protected from accidental dislodgment.

At the other end of bit piece 35, a head 43 is provided which is enlarged relative to shank 37 and which has a flat annular surface on the shank side disposed in a plane perpendicular to the axis of the shank. This annular surface on head 43 is of the same size and shape as sur-

face 15 on ball 13 and is disposed flat against surface 15. Head 43 also has tapered sidewalls 45 which are inclined endwise outwardly away from shank 37. On the front or inner side of head 43, a plurality of projections or knobs 47 are provided which have a special distribution and orientation relative to each other in that the ends of the knobs are disposed in spaced apart relationship about the surface of an imaginary sphere of a diameter substantially greater than the diameter of the sphere of ball 13. The sphere on which knobs 47 lie, like the sphere of ball 13, has its centroid on the axis of shank 37; but the centroid of the sphere on which knobs 47 lie is disposed a substantial distance on the side of the centroid of ball 13 opposite head 43.

For purposes of avoiding confusion of terminology, let it be noted that ball 13, bit piece 35 and key 41 move together as a unit in the assembled device and are therefore referred to as the "tong bit"; while the remainder of the tong, comprising the tong proper, cap 23, shim 25, nut and bolt assemblies 27 and bearing sleeves 29 and 31 move together as a unit and are hence properly referred to as the "tong." It should also be noted that the thickness of shim 25 and cap 23 is such that the inner or forward side of cap 23 is flush with the remainder of tong 5. Also, the flat inner face between ball 13 and cap 23 is parallel to but spaced on the inner side of the flush plane in which cap 23 and the adjacent portions of the remainder of tong 5 are disposed.

In use, bit piece 35 and ball 13 are assembled with key 41 driven through key-way 39 rather forceably so as to insure its retention. The tong bit thus assembled is then seated in the opening of tong 5 and cap 23 added, nut and bolt assemblies 27 securing the device in assembled relationship.

When the bit encounters an ingot or other work piece to be grasped and lifted, the bit tends to swing into the position shown in FIGURE 1 with the axis of shank 37 perpendicular to the ingot. Whether it manages to do so or not is of no importance, for the work piece contacting portions of head 43, comprising the ends of knobs 47, are disposed on the surface of a large sphere so that a plurality of these knobs will always contact the work piece. On the other hand, the center of the sphere on which the ends of knobs 41 is disposed is not coincident with the centroid of ball 13; for if it were, then bit 11 would simply roll with the weight in the manner of a roller bearing. Instead, the centroid of the sphere on which knobs 47 lie is disposed a substantial distance on that side of the plane of shim 25 opposite head 43. Thus,

on the one hand, it is important that knobs 47 not lie in a single common plane, lest the bit fail to turn into full engagement with the work piece and thereby pierce the work piece; but at the same time, it is equally important that the sphere on which knobs 47 are disposed be not of such short radius that its centroid lie on or on the near side of the plane of shim 25.

Bit piece 35 can be replaced when it becomes worn, simply by knocking out key 41 without removing ball 13 from its seat, replacing the old bit piece with a new bit piece and reinserting key 41. Preferably, however, cap 23 is removed and the entire tong bit 11 removed from its seat so as to permit easier access to key 41.

From a consideration of the foregoing disclosure, it will be obvious that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. Lifting apparatus comprising at least one tong and a tong bit carried by said tong for universal movement relative to the tong by means of a ball-and-socket connection having spherical surfaces of a socket carried by the tong in sliding contact with spherical surfaces on diametrically opposite sides of a ball carried by the bit, the tong bit having work-contacting portions projecting beyond the adjacent surface of said tong and lying on the surface of an imaginary sphere which has its center disposed a substantial distance on the side of the center of said ball opposite said work-contacting portions.

2. A tong bit comprising a ball and having work-contacting portions disposed outside said ball and lying on the surface of an imaginary sphere which has its center disposed a substantial distance on the side of the center of said ball opposite said work-contacting portions.

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