Jan. 15, 1963 E. E. HAJEK 3,073,456

CONTROL MECHANISM FOR SWINGABLE BOOMS

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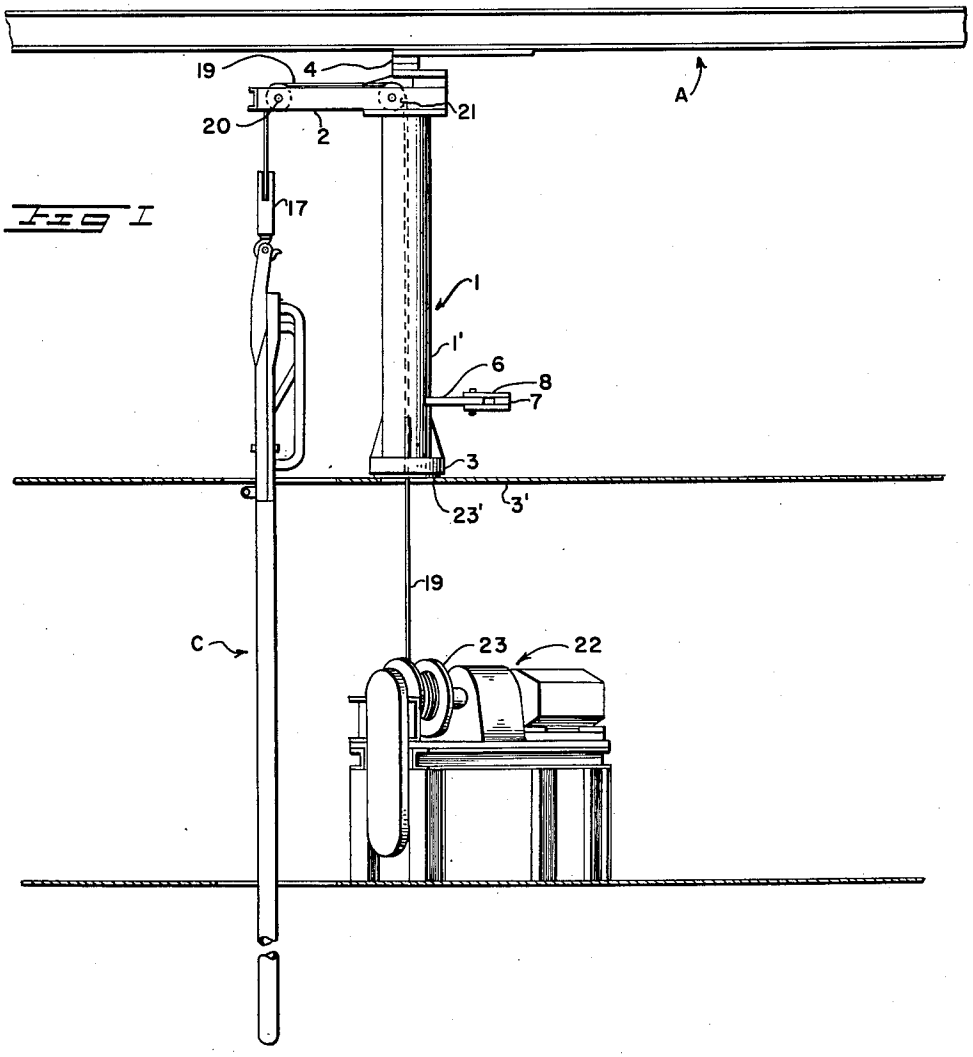
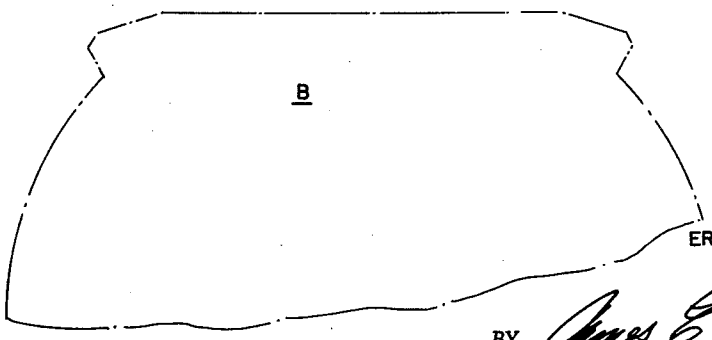


Fig I



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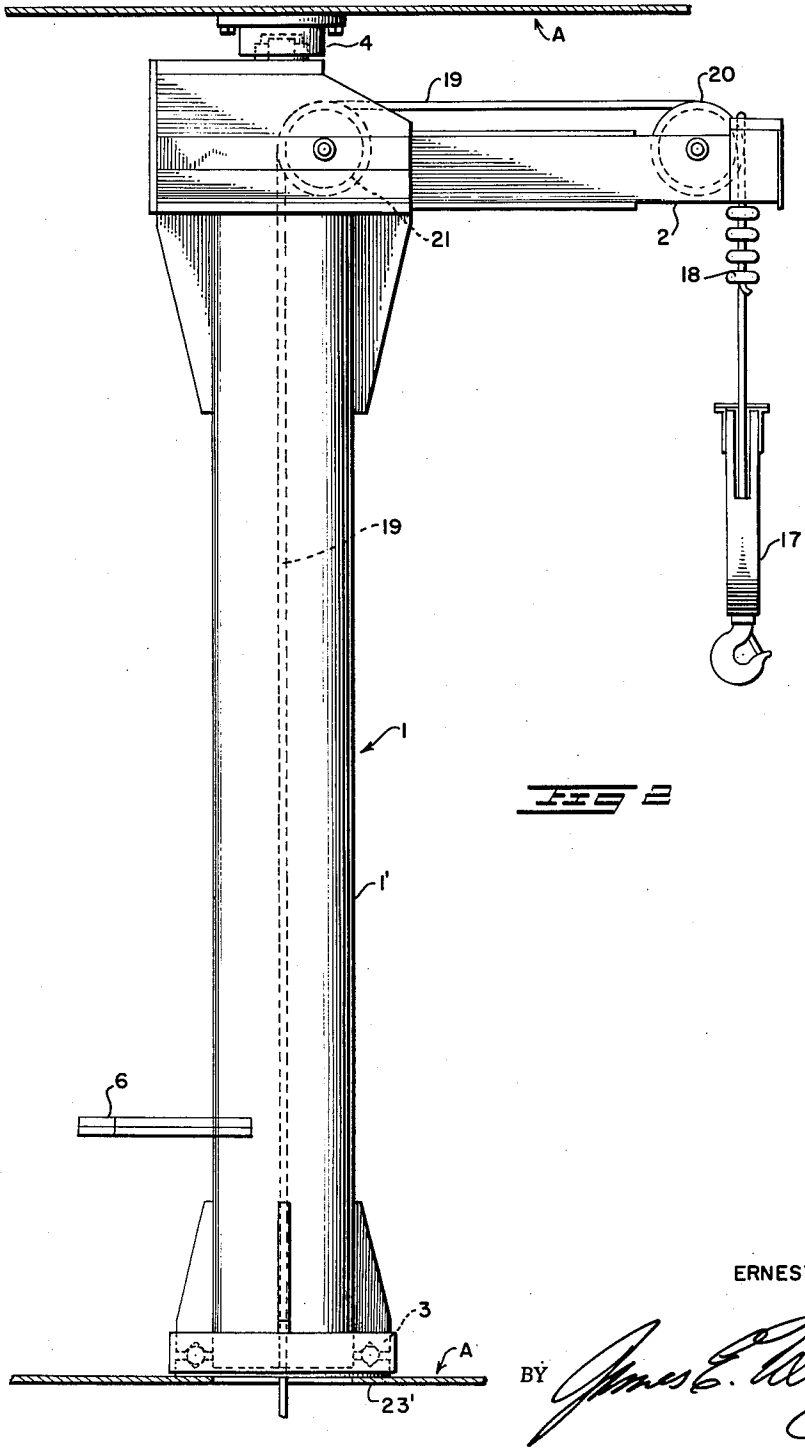


Fig 2

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CONTROL MECHANISM FOR SWINGABLE BOOMS

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Fig 3

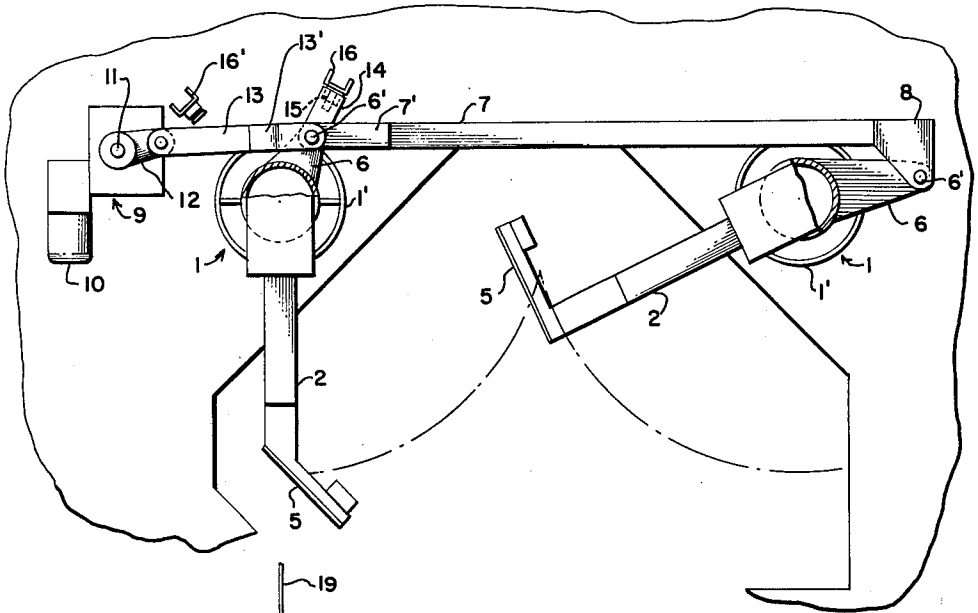
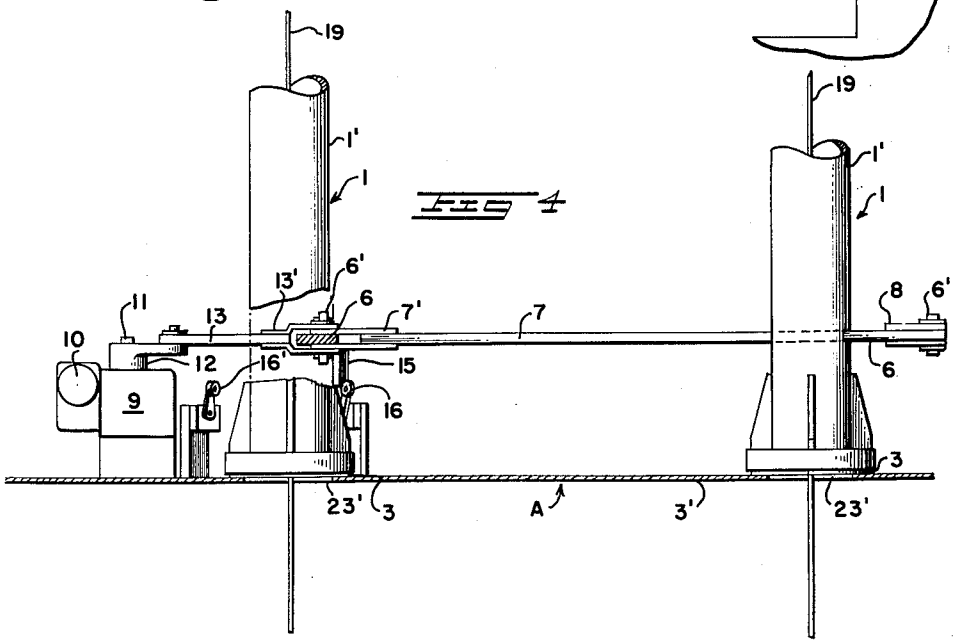


Fig 4



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Fig 5.

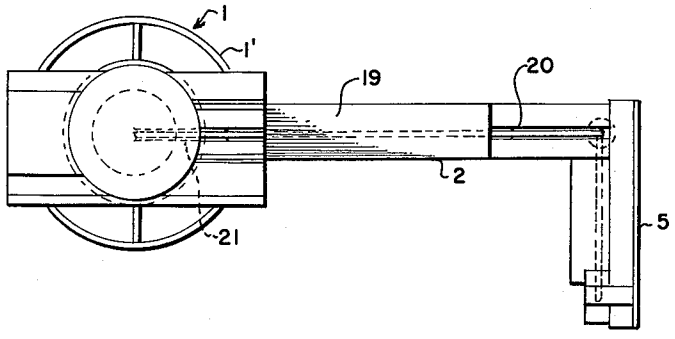
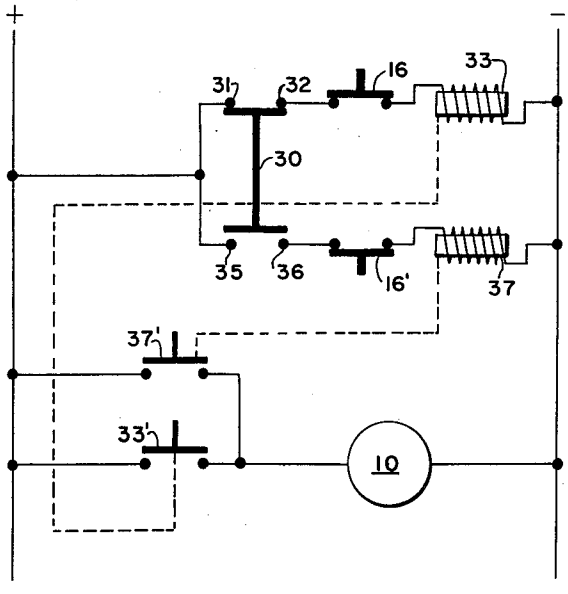


Fig 6.



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CONTROL MECHANISM FOR SWINGABLE BOOMS

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Filed May 27, 1960, Ser. No. 32,257
6 Claims. (Cl. 212—66)

This invention relates to article handling devices. More particularly, it is concerned with providing a novel jib boom operating device for use in selectively positioning or aligning one of a plurality of oxygen-injecting lances with respect to an open mouth steel-making converter or furnace, an example of which is shown in U.S. Patent 2,741,554, issued April 10, 1956.

At the present time, because of the unwieldy and cumbersome types of equipment used, considerable difficulty has been encountered in manipulating oxygen injecting lances with respect to steel-making converters of the type generally shown in the aforesaid patent particularly in those instances when due to the failure of a lance it is desirable to withdraw the same from the converter and to replace it quickly with another lance which has been held in reserve.

Accordingly, it is the primary purpose of this invention to provide an improved apparatus for handling oxygen-injecting lances which are projected into open mouth steel-making converters or furnaces wherein means are provided for quickly and efficiently moving one lance out of position with respect to a converter after it has been withdrawn from the converter at the same time that another reserve lance is moved into a position where it can be readily injected into the converter.

Other purposes and advantages of the instant invention will become more apparent from a review of the following detailed description when considered in conjunction with the appended drawings wherein:

FIG. 1 is an elevational view, partly broken, showing the over-all arrangement of the oxygen lance jib boom apparatus of the instant invention;

FIG. 2 is an elevational view of one of a pair of mast cranes employed with the lance jib boom apparatus of FIGURE 1;

FIG. 3 is a top plan view with parts removed and other parts broken away of the slewing drive part of the apparatus used for moving one lance jib boom out of lance-injecting alignment with the open mouth of a converter while simultaneously moving another lance jib boom into lance-injecting alignment with the open mouth of the converter;

FIG. 4 is a front elevational view, with parts removed and with other parts broken away, of the slewing drive part of the apparatus shown in FIGURE 3;

FIG. 5 is a top plan view of the mast crane shown in FIGURE 2; and

FIG. 6 is a schematic view of a suitable electrical control system that may be used for operating the slewing drive for the jib booms.

With further reference to the drawings and particularly to FIGURE 1, the oxygen lance jib boom apparatus of the instant invention is generally comprised of a pair of mast cranes 1 mounted in a suitable scaffolding or framework generally indicated at A. The framework A is suitably disposed adjacent to and above a conventional upright open mouth steel-making converter or furnace B of a type generally shown in Patent 2,741,554, issued April 10, 1956. Each mast crane 1 is advantageously comprised of a vertical mast or column 1' of hollow construction. The column 1' is pivotally mounted at its lower end in an antifriction type thrust and radial footstep bearing 3 which is suitably anchored in a floor section 3' of the scaffolding or framework A. Column 1' is also held in

constrained alignment at its upper end by means of an antifriction type radial bearing assembly 4 anchored to a structural beam or the like in the framework A.

Fixedly secured to the upper portion of each column 1' is a jib arm 2. Jib arm 2 is provided at one end thereof with an offset and angularly disposed extension 5. It is this extension 5 which is used to hold a vertically adjustable oxygen-injecting lance C which is to be inserted into the mouth of the oxygen steel converter B.

As indicated more particularly in FIGURES 2–4, inclusive, each of the columns 1' is provided adjacent its lower end with a horizontally extending apertured crank or slewing lever 6 that is fixedly secured to the column. The levers for the masts are effectively coupled or connected together by means of a linking rod 7 provided with bifurcated and apertured extremities 7' and 8. The bifurcated extremities 7' and 8 of the linking rod 7 are secured to the slewing levers 6 by means of a pin 6' thrust through the apertures of the bifurcated portions 7' and 8 of the linking rod 7 and the apertures in the slewing levers 6.

It will be noted by particular reference to FIGURE 3 that the bifurcated portion 8 at one end of the rod 7 is offset in order to insure freedom of movement of the various connected elements. In other words, by disposing bifurcated portion 8 at a transverse angle to the longitudinal axis of rod 7, rather than parallel thereto as in the case of bifurcated portion 7', and by making the lever 6 connected to portion 8 longer than the lever 6 connected to bifurcated portion 7' of rod 7, the right-hand jib boom will pivot freely without contacting or interfering with the normal pivotal movement of the left-hand jib boom. This arrangement effectively prevents fouling of the equipment carried by each of the jib boom arms 2. It will also be apparent that this differential arrangement of levers 6 and connecting rod 7 will permit limited synchronized rotation in either direction of the pair of mast cranes 1 about their vertical axes.

The force necessary for rotating the coupled cranes is provided by means of a gear reduction unit 9 which is driven by means of a flange-mounted motor 10. The vertically extending, power take-off shaft 11 of the gear reduction unit 9 has a crank 12 fixedly mounted thereon. The crank 12 is operatively connected by means of yoke 13 provided with a bifurcated portion 13' to the slewing lever 6 of the adjacent mast crane and to the extremity 7' of the connecting rod 7 by means of the pin 6' used to anchor extremity 7' to the slewing lever. An extension 14 on this same slewing lever 6 is provided with a downwardly extending limit switch tripper 15 which is adapted to actuate a pair of normally closed limit switches 16 and 16' in alternate fashion. The arrangement of switches 16 and 16' of slewing levers 6, connecting rod 7, crank 12 and yoke 13 is such that either one of the mast cranes 1 and jib arms 2 can be automatically positioned above and in alignment preferably with the center line of the converter while the other jib arm is simultaneously swung to one side in the manner generally disclosed in FIGURES 3 and 4.

As indicated in FIGURES 1, 2 and 5, the actual lance hoisting means for each of the jib arms 2 generally includes a conventional hoist block assembly 17 dependingly affixed from a fall 18 which is securely attached to the offset extension 5 of the arm 2. A second fall 19 passes over a sheave 20 mounted at the remote end of the arm or boom 2 and rides horizontally and radially inward so that it can pass over a second sheave 21 also mounted on the boom but so located that the fall 19 passing thereover can be carried vertically downwardly in coaxial relationship with respect to the mast column 1'. A conventional power hoist unit 22 provided with a hoisting drum 23 is used with each of the mast cranes. These units are installed in a conventional manner on the floor below that

on which the cranes are mounted and are so located that the hoisting drums **23** are generally in vertical alignment with the center lines of their respective hollow columns **1'**. The fall **19** passes through its respective column **1'** and through an opening **23'** in the floor of the framework A. This opening through which the fall **19** passes is of course made sufficiently large to accommodate the annular displacement of fall **19** resulting from the feeding action of the drum **23**.

From the above, it will be obvious that the power units **22** are operated after the lances C have been moved into and out of position with respect to the vertical center line of the converter by means of the slewing drive arrangement discussed above.

During operation of the slewing drive device, reference being had particularly to FIGURES 3 and 6, the operator presses a suitable double and oppositely acting switch **30**. This causes a closing of contacts **31** and **32** and an energization of solenoid **33**. Energization of solenoid **33** causes the closing of switch **33'** and a rotation of motor **10**, which is of a reversible type, in one direction. In this instance, for example, the motor would operate to move the right-hand jib arm **2** shown in FIGURE 3 to the left and the left-hand jib arm **2** as shown in FIGURE 3 also to the left and out of position over the furnace or converter as the yoke **13** moves outwardly or to the right as shown in this FIGURE. These movements of the jib arms continue until such time as the switch tripper **15** on the one slewing lever **6** contacts the limit switch **16**. Contact between switch tripper **15** and switch **16** causes switch **16** to open, thereby de-energizing the solenoid **33**. When solenoid **33** is de-energized, switch **33'** opens and the motor **10** stops.

At the same time, of course, switch **30** maintains the contacts **35** and **36** open so that there is no energization through the medium of solenoid **37** and switch **37'** of the reversible motor **10** in an opposite direction.

In order to move the jib arms **2** in an opposite direction to that previously described whereby the left-hand jib arm **2** will be moved into position over the top of the furnace, switch **30** is moved in the opposite direction thereby opening contacts **31** and **32** and closing contacts **35** and **36** and the line to solenoid **37**. The closing of contacts **35** and **36** causes the energization of solenoid **37**, the closing of switch **37'**, and a movement of motor **10**, yoke **13**, rod **7** and levers **6** in the opposite direction until such time as the switch tripper **15** contacts the normally closed switch **16'**. Upon contact between tripper **15** and switch **16'**, switch **16'** opens whereupon solenoid **37** becomes de-energized. The de-energization of solenoid **37** produces the opening of switch **37'** and a stoppage of motor **10**.

It will be obvious from the above description that a novel yet simple and efficient device has been provided for handling oxygen lances used with open mouth converters whereby one oxygen lance after it has been withdrawn from a converter can be quickly and efficiently moved out of the way and a reserve lance moved into a ready position over the open mouth converter.

It is also obvious that various changes and modifications may be made in the instant invention without departing from the spirit and scope thereof as defined by the appended claims wherein, what is claimed is:

1. In a slewing drive device for article handling apparatus, the combination of a plurality of pivotally mounted and spaced masts; jib arms, from which articles can be suspended, secured to each of said masts; differentially disposed lever means and link means coupling said masts together; and means for actuating said lever and link means to effect a simultaneous movement of all of said masts and jib arms in the same direction without interfering with each other, whereby one of said jib arms and the article suspended therefrom will be moved to a predetermined position while another jib arm and the article suspended therefrom will be moved to another predetermined position.

2. The combination as set forth in claim 1 wherein said lever and link means include a linking rod hingedly connected to each of said masts.

3. The combination as set forth in claim 1 including means for automatically stopping the pivotal movements of the masts along with the jib arms at predetermined positions during the pivoting of the masts in either direction.

4. A slewing drive device of the type described, comprising in combination a plurality of pivotally mounted masts; an oxygen lance-carrying jib arm secured to each of said masts; and means for simultaneously pivoting said masts and for moving said jib arms above and into and out of alignment substantially with the center line of the open mouth of a converter, said means comprising a power take-off yoke, differentially arranged slewing levers secured to each of said masts, a connecting rod coupling said levers together, means connecting said yoke to said connecting rod and to one of said levers, and motor means for selectively moving said yoke in different directions.

5. A combination as set forth in claim 4 including stop means engageable by one of said levers for limiting the movement of said yoke and said masts.

6. A combination as set forth in claim 5 wherein said stop means includes circuit means and switches in said circuit means engageable by one of said levers.

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